The Electrical Journal

AN ILLUSTRATED REVIEW OF THE INDUSTRIAL APPLICATIONS OF ELECTRICITY, GAS & POWER.

VOL. I, NO. 2. SAN FRANCISCO, AUGUST, 1895. PRICE, 10 CTS.

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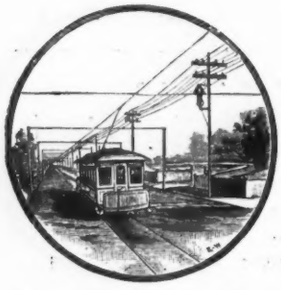

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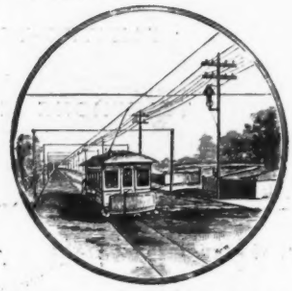

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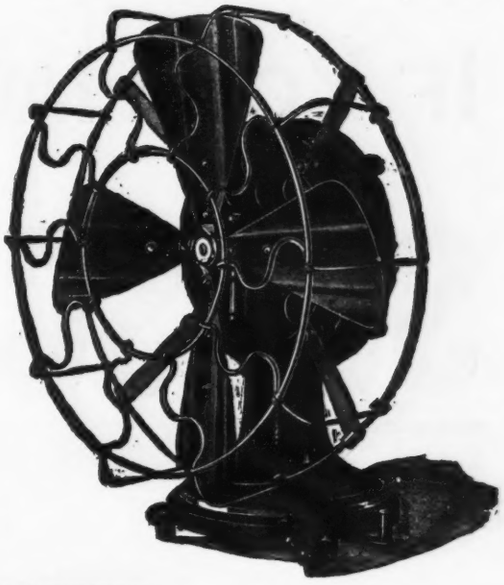

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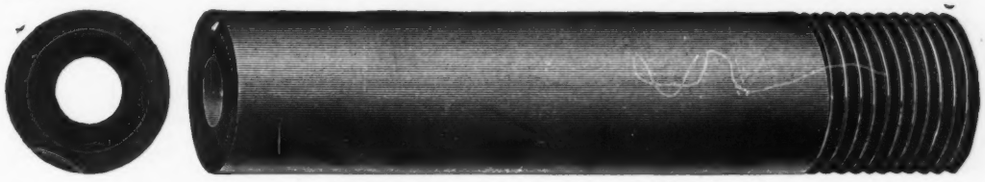

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THE ELECTRICAL JOURNAL.

VOL. I. AUGUST, 1895. No. 2.

Steep Gradients on Electric Roads.

BY LIEUT. W. STUART-SMITH, U. S. N.

Some years after the completion of the Richmond Electric Road, and when facts had demonstrated that electric traction was an assured success, Mr. Frank J. Sprague gave an account of some of his experiences showing the difficulties to be overcome. Among other things to be surmounted was a grade of 10 per cent., and so great did the undertaking seem that Mr. Sprague and his engineers were fearful of possible failure until the trial car actually began to mount upward. Just before reaching the foot of the grade there was a general expression of fear as to the result of the attempt, the only confident member of the party being a machinist, who was willing to risk his hard-earned dollars that the car would go up. As the grade was reached and the car started smoothly upward the hearts within it beat joyfully, but soon unpleasant sounds and bad smells came from beneath the car and the joy was not unalloyed. The top was reached and the fact demonstrated that a self-propelled car would go up a 10 per cent. grade; also that the 5 h. p. equipments with which the car was provided were far too small.

Mr. Sprague remarked to Mr. S. Dana Greene that some instruments were needed, and these were presently brought—four strong mules. With stronger motor equipments the "instruments" became unnecessary, and as improvements were made steeper grades were overcome until hills nearly ceased to be a terror to street railway engineers. At present, with the powerful equipments provided, grades having nearly the greatest theoretical possible rise up which self-propelled vehicles can go are undertaken. In many places, however, notably in San Francisco, the grades are so great as to be beyond the power of any car depending upon the friction between wheels and track to surmount. As such grades are generally short—one to three blocks—a simple and successful method by which self-propelled cars could mount them would permit the extending of electric traction to all parts of the city, and a description of some of the plans in operation and proposed may not be uninteresting.

FIG. 5.—THE FILLMORE STREET GRADE IN SAN FRANCISCO—25½ PER CENT.

One of the first attempts to overcome excessive grades was made in 1887 by Mr. Leo Daft, in Pittsburg,

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Pa. The grade was about 16 per cent., and with the equipments then in use could not be overcome by direct traction. The old style Daft locomotive was used to haul trailers. The heavy motor was carried inside the locomotive and geared to the axle by a sprocket chain. A small shaft carried in a pivoted framework was also driven by a chain. This shaft carried a sprocket wheel, the projections of which entered holes in an iron plate which was laid between the rails on the grade. When running on the level the movement of a lever raised the sprocket wheel clear of the road and on the grade being reached it was lowered, and, gearing with the perforated plate, assisted the car up the hill. It was used for a few months only. Various other methods of assisting a car up grades by the use of rack and pinion have been proposed, but for ordinary street service none of them have come into permanent use.

On the line of the San Francisco and San Mateo road, in San Francisco, there is a grade of nearly 18 per cent. on Harrison street, between Second and Third, down which cars go on the uptown line. No attempt is made to climb this grade, it being overcome in two stages on another street. When the road was first built it was considered dangerous to descend this grade without some retarding force other than that carried by the car, and a weight was lowered from the bridge at the Second street cut. As the car descended it raised this counterweight to the top by means of a rope, and the work thus done made it impossible for the car to run away. After the car reached the foot of the grade the counterweight was lowered to the bottom by means of a drum, and was ready to assist the next car. The arrangement was a bother, and after the motormen became more skilled in handling the car it was discarded and the descent made on wheel brakes alone, with the assistance of plenty of sand.

An arrangement patented by a Mr. Kuhlmann has been in successful operation for the past three years on a single track road in Seattle, Wash. The operation is made clear by the accompanying illustrations. In Fig. 1, A is the main car track and B an auxiliary track in a subway which extends the length of the grade. Near one of the main rails is a conduit slot, D. At the top and bottom of the grade are sheaves, around which passes a rope, the ends of which are made fast to a car carrying slabs of lead, O. O , the total weight of which is seven tons. Buffers (E. E.) having air cushions are provided at the top and bottom to arrest the motion of the counterweight car. Figs. 2, 3 and 4 show plan and elevation of the coupling by means of which the car is connected to the rope. Its position on the rope is shown at H, Fig. 1. The link M, secured to the rope as shown, carries the pivoted piece K, the head H, of which projects above the slot, as in Fig. 3. The drawbar I is permanently carried by the car, and when desired it is coupled to H by means of the loose pin J.

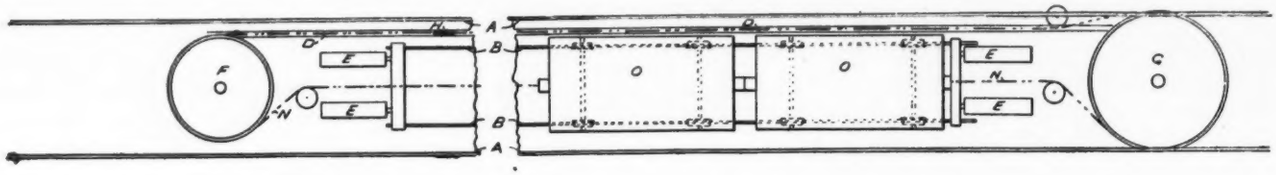


FIG. 1.—STEEP GRADIENTS ON ELECTRIC ROADS. THE SEATTLE COUNTER WEIGHT.

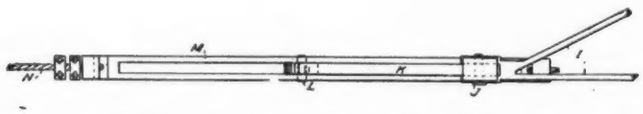


FIG. 2.—STEEP GRADIENTS ON ELECTRIC ROADS.

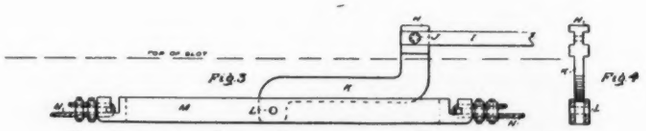


FIG. 3 AND 4.—STEEP GRADIENTS ON ELECTRIC ROADS.

The operation is as follows: The road is single track and is used by cars going in both directions. Suppose the counterweight is at the foot of the grade and a car is starting to go down. The drawbar is coupled to the brake and the descending car pulls the counterweight to the top, where it passes over a slight reverse grade to prevent its running back. The next car coming up grade finds the coupling at the foot, and after making connection uses its motors to pull the weighted car over the slight reverse grade when the descending weight assists the car in mounting. This grade is but 16 per cent., and under such conditions as exist in San Francisco, and with modern equipments, would no doubt be taken without any outside assistance, but the cars in Seattle are equipped with the old style of F 15 double reduction motors which are not powerful enough for that grade, and moreover the track in winter is very slippery with ice and snow. The same arrangement was installed in Portland, Or., and Providence, R. I., but the writer does not know whether they are now in use.

San Francisco is pre-eminently a city of heavy grades, the overcoming of which was the incentive which led to the development of the cable system for street-cars. Up to a year ago there were but two elec-

tric roads in the city, the San Francisco and San Mateo and the Metropolitan. When the Market-street Company obtained possession of nearly all the street-car lines in the city it turned its attention to electricity as a motive power and the success of the first road, the Mission-street line, was so marked that the work of electrically equipping other roads was rapidly pushed until at this present writing the Company has many miles

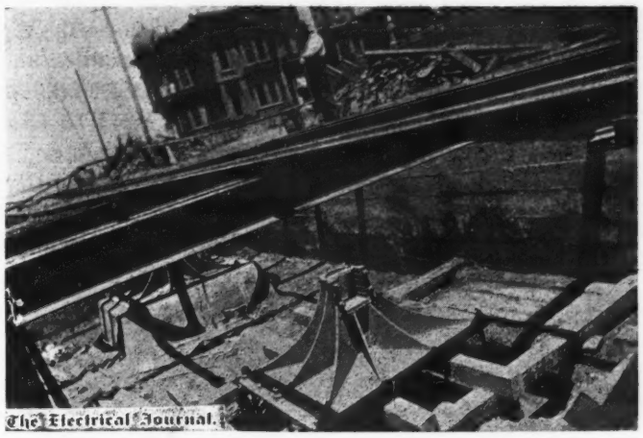


FIG. 6.— STEEP GRADIENTS ON ELECTRIC ROADS.

in operation and many more under construction. The first roads equipped were those having grades that could be easily surmounted, but when the cross-town line on Fillmore street was undertaken very heavy grades were encountered between Green street and Broadway. From Green to Vallejo street the grade is 25½ per cent., and from Vallejo street to Broadway it is 24 per cent. These were too heavy for direct traction, and plans were devised in the office of the Company's engineers which, will undoubtedly solve the problem of overcoming steep grades and permit the electrical equipping of all the cable lines. The views given show the condition of things at this writing.

The view (shown in Fig. 5) looking up grade is from Vallejo street toward Broadway, and shows an ordinary cable construction, the only difference being a guide 4" x1", which extends the length of the conduit at about half the depth of the conduit as in Figure 9. An endless rope will be used which passes around sheaves in pits at the top and bottom of the grade, the sheave at the bottom being carried in a cradle, by means of which stretch of the rope can be taken up. In the upper pits —a photograph of which showing the main pedestal is given in Fig. 6—are two sheaves, the forward one being an idler and the after one the main sheave. The cable coming from the conduit on one side passes around the main sheave, then forward around the idler, back to the main sheave, around which it makes a second turn, and thence to the other conduit. This gives so much hold as to prevent any possibility of slipping of the rope. The main sheave is provided with a brake, the lever of which is located so that a man can see the cars on grade and at once apply the brake in case the draw pennant connecting either car to the rope should give way and leave the other car free to run down hill.

At two points on the rope are clamped travelers which ride on the guides and prevent the rope being pulled upward into the slot. The position of these is such that when one is at the top of the grade on one track the other is at the bottom on the other track. The sketch presented in Fig. 8 shows the construction clearly, and it will be seen that it is impossible for them to get off the guidebar. They project a short distance above the slot and are provided with holes to which draw penants about ten feet long are shackled. Two short penants are secured to the car, one to the car body and one to the track, the duplicate arrangement being for safety only. The penants on car and cable carry halves of a coupling which are secured together by a pin which locks with a half turn. The coupling and uncoupling will be done by men stationed at the ends of the grade. Double crossovers are provided at both top and bottom of the grade, so that cars can pass from one track to the other. The necessity for this will readily be seen.

In Seattle, on the Union Trunk Line, a cable and electric line used the same track on a steep grade, and though the electric car could go up the grade alone, it was considered not altogether safe, especially in winter, and an attempt was made to obtain assistance by coupling to the cable dummy. The electric car was too heavy and the motors were used to take the strain, and trouble was at once experienced. The old style Edison controller was used, and it was impossible to obtain even an approximate agreement between the speed of the cable and that at which the electric car tended to run. The cable speed was so slow that the armature speed was forced down to a point where the current taken was more than it could stand, and after several severe burnouts the plan was abandoned.

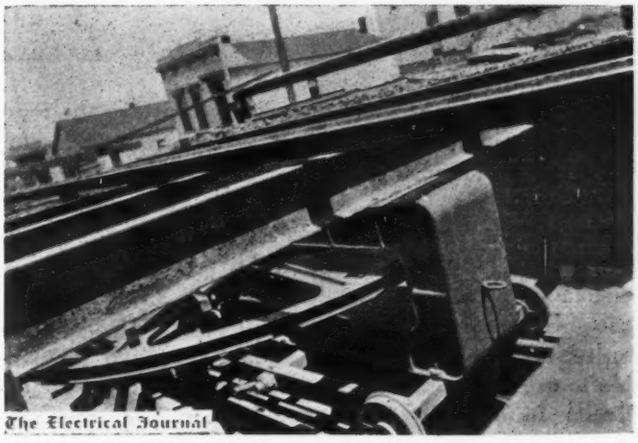


FIG. 7.—STEET GRADIENTS ON ELECTRIC ROADS.

It is desired, if possible, in this Fillmore street installation, to make use of no other power than that which can be obtained from the car motors, the rope ordinarily being dead, and the first trials are to be made with this end in view, the operation being as follows: Suppose a car approaches the top of the grade and wishes to go down. It finds the traveler on that side and couples to it by means of the penants. At the same time a car at the bottom on the other track couples

to the traveler found there. Both cars will use their motors, the ascending one doing its best to climb the grade, and the descending one pulling on the cable, thereby assisting the one climbing up. The motor equipments on each car have a nominal rating of 50 h. p., with a capacity of 100 per cent. advance on this rating for short periods. Thus, the descending car is capable of exerting 100 h. p. on the rope, and as the two cars are balanced against each other, this power is available for overcoming the friction of the rope, sheaves, etc., and caring for a possible difference between the loads of the ascending and descending cars.

The engineers in charge of the work have so much doubt of the success of this plan of working, that the upper pit and the entire length of the conduit is to be left open until after a trial, in order that changes may be made in case of necessity. The change would be the installing of a stationary motor in the upper pit and using it to drive the main sheave, and with it the rope, but in the opinion of the writer the plan as above outlined will be found to give perfect success.

The cars are not in a position to make use of the entire weight for traction purposes, but the component of the weight normal to the rail will probably be sufficient to prevent skidding of the wheels, in which case the entire power of the motors will be available, and the writer believes that in case it should be found impossible to use the motors of the ascending car, owing to difficulty in obtaining a balance between the electrical conditions of the two car equipments, the power of the descending car will be ample for hauling the other up grade. This confidence is based on the experience of the Kyoto Canal Company, Kyoto, Japan, the working of which the writer had under observation for two years.

The Kyoto Canal connects with Lake Biwa, and upon reaching the suburbs of Kyoto, it finds itself far above the level of the section running through the city. This difference of level is overcome by an incline railway 1,800 feet long, up and down which boats are hauled in cradles, one of which is attached to each end of a cable operated by a 50 h. p. Sprague motor. At the top of the main grade there is a short reverse grade, down which the cradle descends into the water to receive or discharge a boat. The motor is geared to a large drum by several reductions, the loss in which is necessarily considerable. When the motor starts and the cradles at both ends of the rope are being hauled out of the water and up the inclines the motor develops about 50 h. p., but as soon as the one at the top passes over the crest and the weight of the cradles and boats are balanced against each other the power falls to about 5 h. p., this being all that is required to haul 1,800 feet of rope and overcome loss in gearing, etc.

Reverting to the street railways, the power that may be required for moving the cars in an extreme case is easily shown. Suppose the car going down grade is empty and the one coming up is carrying 100 passengers,

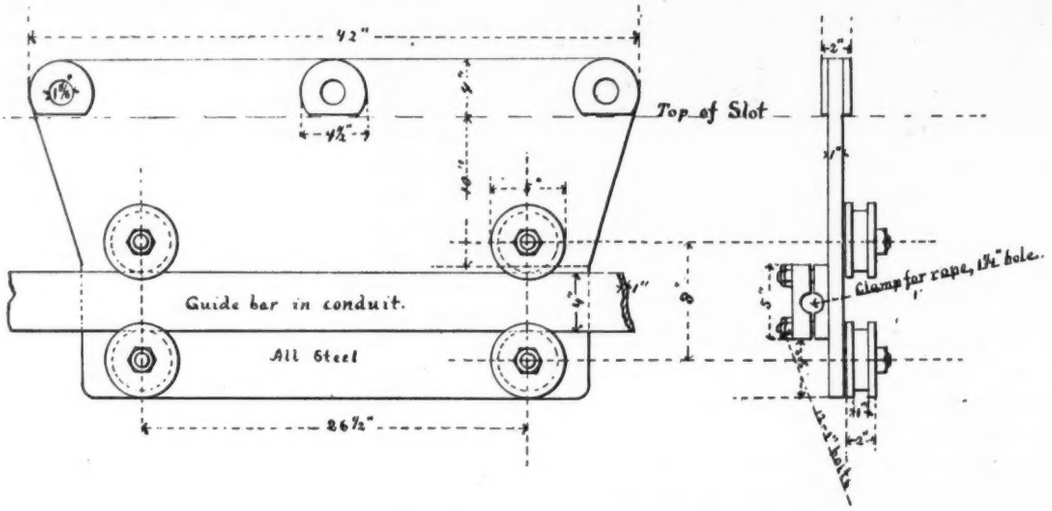


Fig. 8.—Steep Gradients on Electric Roads.

having an average weight of 120 pounds, or a total load of 12,000 pounds. If the speed is eight miles per hour the vertical rise on a 25 per cent. grade will be 176 feet per minute, which for the load of 12,000 pounds will require 64 horse power. This added to the 5 h. p. required to haul rope, etc., will make 69 h. p. required in an extreme case As there is available 100 h. p. on the descending car alone, it is evident that the power is ample.

Moreover, with the series-parallel controller and the much greater range of working than was possible in the above mentioned Seattle failure, there should be no difficulty in the ascending car using its motors. When the cars are coupled to the rope and the grade taken, for similar positions of the controller on the two cars the speeds will tend to be very different, and as they must have the same speed, owing to their connection with the rope, trouble may be experienced, but as the rope is not fixed in its speed, being controlled by the cars themselves, after some hunting the motors should settle down to a common speed. The wide range of working possible with the series-parallel controller will assist in this,

and after the motormen have had some experience, a balance should be quickly attained.

Considerable curiosity has been expressed as to the use of the double cross-over at top and bottom of the grade (Fig. 10). The *raison d'etre* is plain. The car coming up on the proper track will leave its traveler on the wrong side for the next car going down, and hence this car must cross over in order to couple to it, and similarly, the ascending car must cross over at the bottom in order to get the lower traveler. At top and bottom they must again cross to their proper track. Thus

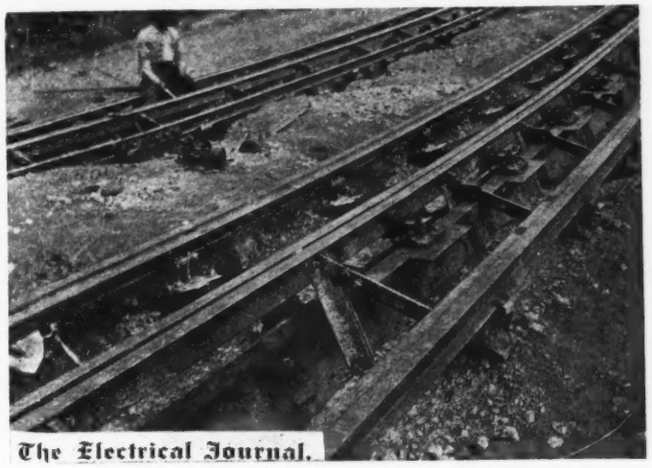


Fig. 9.—Steep Gradients on Electric Roads.

every other car going in either direction must cross over.

Another plan for climbing grades is the electric tractor, invented by a Mr. Van Zile. It is built on the principle of automatically controlling the traction between a middle rail called the traction rail and two drivers, which are toggled together at an angle in such a manner as to grip the traction rail between them. The amount of pressure is directly controlled by the tractive force required. As a middle rail somewhat raised above the street surface is required, this plan is hardly likely to be applied to street car service.

* * * * * * * *

On Monday, Aug. 5th, the plan above described was tested and found to work so successfully, as to be really monotonous. An old-time bobtail car was first lowered down, secured to the rope and used as a drag to assist in lowering the first heavy electric car. Two electric cars were then secured to the rope and tests made with the cars loaded in various ways. The car coming up grade with a considerable load made no use of its motors and was readily pulled up by the empty descending car with controller on second notch, showing, as the writer expected, that the power of one car is far more than necessary for hauling the ascending car under any possible condition of load, and settling once for all the question as to whether it would be necessary to install a stationary motor in the pit. Previous to the tests, the writer was informed that the consulting electrician of the company, Mr. S. L. Foster, doubted the success of the plan, but during the tests he said there was at no time any doubt in his mind, as from the beginning he was confident of success. There were many doubting Thomases, but he was not one of them.

The system was under hard test daily until Saturday, July 10, when the regular service on the Fillmore street line was extended to the bay, covering the grades here described and the scheme is now working to perfect satisfaction.

The Market Street Company is to be congratulated upon having found a simple and successful solution to a difficult problem.

STATICAL ELECTRICITY IN HISTORY.

San Francisco Council, No. 1, of the National Convention of Stationary Engineers, has engaged the services of Mr. M. A. de Lew, E. E., M. E., LL. B., to deliver three lectures on electricity. The first was given on Thursday, Aug. 1st. His subject was "Statical Electricity." In the course of his remarks he spoke of some of the popular delusions. He contended that Dr. Benjamin Franklin was not the first to discover atmospheric electricity. He gave the discovery to the people who named the Pyramids, stating that they noticed a blueish flame at the tops—hence the name, which means fire-mounds. His next allusion was to Flavius Joseph, known as Josephus, the commentator on the Old Testament, who says that the priests of the Tribe of Levi put pillars around the Temple of Solomon to protect it from "heavenly fire." Even supposing that the story as above told by Josephus was without foundation, it does not remove the fact that Josephus himself perfectly understood the principle upon which to protect buildings. What he termed as something in proof of the foregoing statement was in "Gibbons' Rome." During the reign of Julian the Apostate he ordered the Temple of Solomon to be rebuilt (which was destroyed). The work was somewhat under way when it was struck by lightning, as in the course of reconstruction they failed to take the precaution that was taken while it was first being built. Socrates agrees with the foregoing statement.

Fig. 10.—Steep Gradients on Electric Roads.

The lecturer also questioned the old theories of positive and negative conditions in relation to electrical changes, which was accompanied by numerous illustrations, concluding that positive was the presence and negative the absence of electricity, indorsing Dr. Franklin's theory on that point.

Mr. de Lew did not seem to think that electricity was a name in the least applicable; on the contrary he thought the name Lord Lytton gave it, "voil," as in every way superior. After the foregoing statements the lecturer concluded with several illustrations regarding lightning and artificial statical (so-called) electricity. The audience evinced warm appreciation of the interesting lecture given.

A GENERAL ELECTRIC SINGLE PHASE POWER TRANSMISSION PLANT.

It is not well known that the General Electric Company has exploited a synchronous system of electric power transmission, but the interesting plant installed by that concern for the Walla Walla (Wash.) Gas and Electric Company, in the spring of 1893, demonstrates this fact. The features of the installation are so distinctive and the plant being placed at a time when the company named was believed to be strenuously endeavoring to devise a system of power transmission that would, at least, be abreast of other manufacturers, lead to the conclusion that the plant in question formed a stepping stone in the development of the art. At that time single phase transmission was in successful operation at Telluride, Col., using the synchronous system of the Westinghouse Electric and Manufacturing Company, and a similar plant was about to be installed by the Standard Consolidated Mining Company of Bodie, Cal., but polyphase transmission was practically unknown in commercial circles. The Walla Walla Gas and Electric Company felt it to be imperative that the water power of Mill Creek should be utilized to operate its electric light and power plant, and the installation described was placed. That it operates satisfactorily is unquestionable, but it is improbable that similar conditions would now be satisfied by the installation of a plant of its character.

The generating station, which is situated on Mill Creek, a distance of four miles from the city receiving station, is operated by water power, the water being brought in a wood stave pipe, 48 inches in diameter, and having a total length of 6000 feet. The effective head is 66 feet and the wood pipe terminates in a sheet iron Y pipe, supplying two Pelton wheels that are 6½ feet in diameter, supplied with double nozzles and run at 100 revolutions per minute. The capacity of the wheels are 175 horse-power each, which is transmitted to the main countershaft by means of two endless compound rope drives, all as shown in the accompanying outline cut of the plant (Fig. 1.) The dynamos are belt driven from the countershaft, and the plant was laid out for double its present capacity. The synchronous motor at the city station operates power and lighting generators.

The generating station contains one 100-kilowatt single phase 2000-volt Thomson-Houston generator, having a frequency of 8000 and being composite wound, together with one 15-kilowatt 500-volt exciter, which from the manner of its use, also becomes a starting

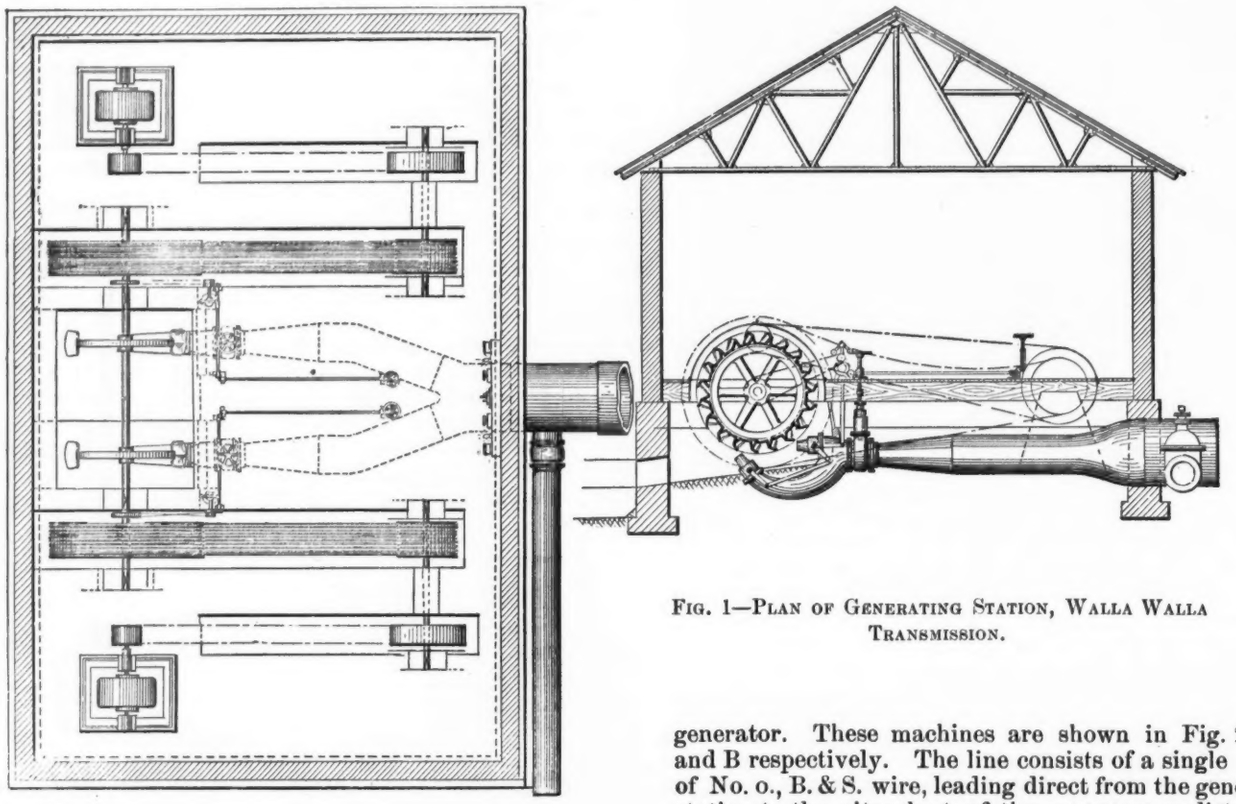


FIG. 1—PLAN OF GENERATING STATION, WALLA WALLA TRANSMISSION.

generator. These machines are shown in Fig. 2 as A and B respectively. The line consists of a single circuit of No. o., B. & S. wire, leading direct from the generating station to the city plant of the company, a distance of about four miles. This receiving plant contains one 100-kilowatt 2000-volt synchronous motor, designated as C, one 7½ horse-power direct current bi-polar starting motor, shown as D, and a small 1½ kilowatt 110-volt exciter, E, used for the fields of the synchronous motor, and for operating the station lights. The starting motor, D, drives a countershafting, to which is also belted the small exciter, E, and the synchronous motor C. The line terminates at each end at the levers of double pole, double-throw switches, so coupled that at the generating station the line may be thrown either upon the 500-volt exciter or the 2000-volt alternator, and so that at the receiving station the line may be thrown upon the bi-polar starting motor, or upon the 2000-volt synchronous motor. The switchboards at the two stations contain all the forms of instruments usual for the purposes of the currents handled, the entire equipment being complete in every detail.

The method of putting the plant in operation is as follows: The generating plant is brought up to speed and the rheostat in the fields of the 500-volt exciter is cut out for maximum voltage. The fields of the generator are excited therefrom, no attention whatever being

paid to the voltage of the alternator. The double pole, double-throw switch is then brought down upon the jaws forming the terminals of the 500-volt exciter, which throws its potential upon the line. The attendant at the generating station has, in the meantime, telephoned to the attendant at the receiving station that he has started up, whereupon the latter throws the line current upon the small starting motor by bringing down the switch upon its terminals, as shown in the diagram. The starting motor then brings the synchronous motor and its exciter up to speed through countershafting. The armature of the alternator runs idle in dead fields, but the exciter is brought up to voltage and connected with its pilot lamp to avoid error. When the synchronous motor has been brought up to proper speed, the station attendant telephones to the power plant to stand by the main switch, whereupon the motor attendant opens up the main switch and quickly throws in the station transformer operating the pilot lamp and volt meter on to the line through a primary switch, and then waits for the appearance of the 2000-volt alternating current before closing the main switch that throws the line to the synchronous motor.

In the meantime, the attendant at the generating station, who, in compliance with instructions from the motor station attendant, has been standing by the main switch, quickly throws the main switch from the 500-volt contact to the 2000-volt contact as soon as he sees the needle of the current indicator drop back to zero, which obviously is positive information to him that the attendant at the receiving station has cut the starting motor off the line. Thereupon the attendant at the motor station, who has been watching the pilot lamp operated from the station transformer, throws the line upon the synchronous motor with one hand as soon as the lamp comes up to candle power, and immediately closes the field circuit of the alternator with the other hand. The motor at once comes in step, the starting motor is then shut down by throwing the clutch on its countershaft pulley, and the plant does its work with perfect satisfaction.

The method of starting was designed by Mr. W. A. Burkholder, then District Engineer for the Pacific Northwest district of the General Electric Company, and who is now General Superintendent of the Portland (Ore.) General Electric Company. Provided the speed of the synchronous motor is higher than that of the generator, the motor will invariably synchronize with the generator, and has never given any trouble whatever.

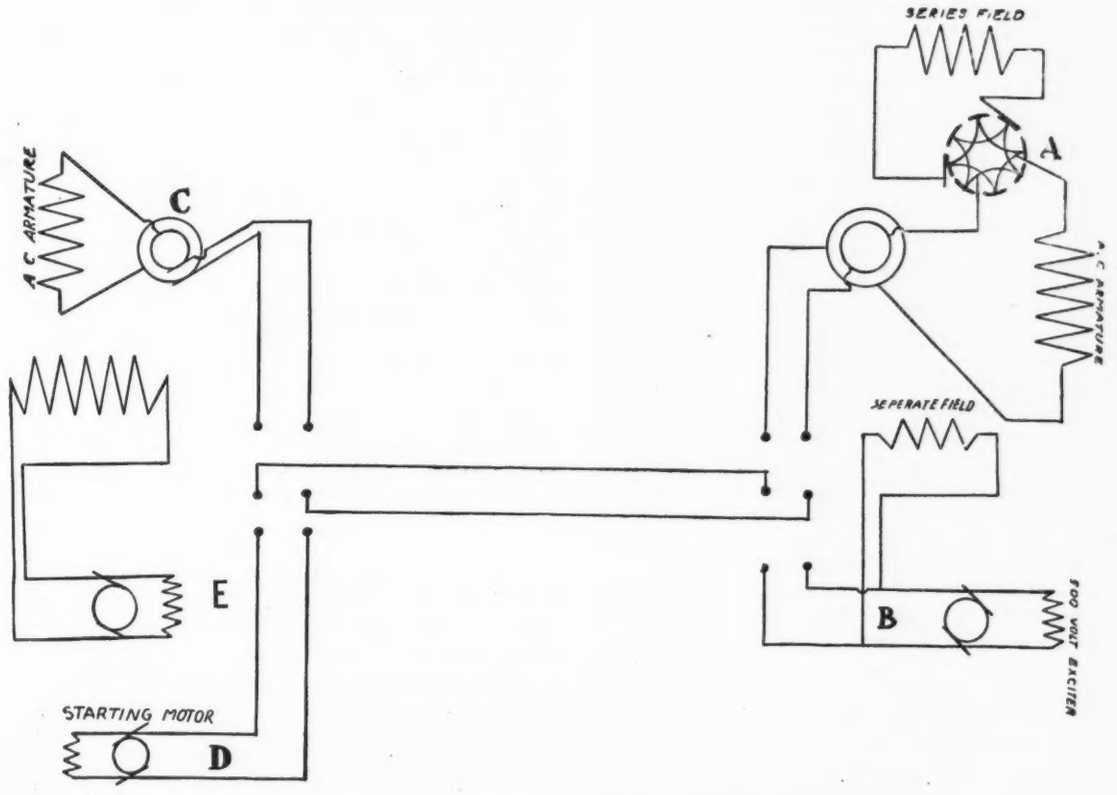


FIG. 2.—CIRCUIT DIAGRAM OF THE WALLA WALLA TRANSMISSION.

"AS OTHERS SEE US."

"Kindly accept my congratulations upon the handsome and meaty paper you have started, and let me offer my best wishes in your enterprise."—D. C. Jackson, Professor of Electrical Engineering, University of Wisconsin, Madison, Wis.

The advent of a serial devoted to electrical matters and interests is not an unexpected circumstance in San Francisco. Trade, scissors and paste have their necessary place in the make-up of serial literature on this coast, removed as it is some thousands of miles from other fields of like activity, but there should be other components in respectable make-up, and these are conspicuous in the present issue of THE ELECTRICAL JOURNAL.

We welcome our contemporary as an example of "honest goods" provided out of investment and work, and trust that the standard here set up will be maintained.—Industry, San Francisco.

NIAGARA'S WONDERFUL PLANT.*

The recent meeting of the American Institute of Electrical Engineers at Niagara Falls was a most important one mainly because of the attendant circumstances, the far-reaching effects and the part they will play in the history and development of the applications of electricity. The wonderful work accomplished by the Cataract Construction Company of course o'ershadowed all else in point of interest, and when, in the course of that afternoon, that portion of the programme was reached stating that "At 2 o'clock take carriages for Power House of the Niagara Falls Power Co., the Pittsburg Reduction Co., etc.," everybody was on the tip-toe of expectancy, for we were to see for the first time the big 5000 horse power dynamos. This was to be the opening day at the Power House and the first public exhibition which had been given. Promptly at 2 o'clock all were ready, and after a short drive we all reached the Power House. It is not an imposing looking structure, but it gives the impression of solidity, and has a built-to-last kind of air. The Institute button admitted all the members and guests, and when we stepped inside there it was—5000 horse power, revolving at a high speed, and yet so quietly and evenly that there was not a tremor. No. 1 was the dynamo which was running, though No. 2 was all set up. The switch-board instruments read 2400 K. W. on one side of the two-phase circuits. The power was being absorbed by a water rheostat, connected directly to the armature circuit without the intervention of transformers. The coils were of No. 2 iron wire, immersed in two large wooden tanks sunk below the level of the canal. Water was brought, under a head of five feet, through two pipes, one three and the other four inches in diameter. The supply of water was evidently no more than enough to keep the coils cool, for it was bubbling and boiling at a tremendous rate. The tanks were considerably below the floor level, and the coils were thrown in by switches, putting on a greater or less load as occasion might require. They had had a load of 5500 horse power, but at this rate the thrust of the vertical shaft was upwards, and the collars on the thrust-bearing had not yet worn down enough to carry it continuously, so they limbered up by degrees.

A piece of machinery which seemed to attract quite as much attention as the dynamo itself was the governor. It was made by Faesch & Piccard, and certainly performed its work well. It was driven by gearing from the main shaft, and operated to raise or lower the ring-shaped gates which governed the amount of discharge, thus throttling the water. When the dynamo was at its normal speed of 250 revolutions per minute, the whole load of 5000 horse power could be thrown off instantly by opening the field-switch, and the speed would only increase seven revolutions, a variation of less than 3 per cent. This was well within the guarantee, and may be considered quite a remarkable performance. The turbine wheel itself was very ingeniously arranged to meet the severe conditions. With a head 140 feet high and the amount of water required to develop 5000 horse power, the pressure on an ordinary step-bearing would have been something enormous, and would have been a very serious problem. But it was entirely provided for by forming the turbines of two wheels, one above the other, the water entering between them, and by forming the disk of the upper wheel solid, so that the weight of the shaft and revolving parts of the dynamo were entirely supported by the upward thrust of the column of water.

A trap door was provided in the floor directly over the wheels, and, on prying this up, the roaring, foaming mass of white water could be seen tumbling about below. There was a terrific downward rush of air, which made the door very hard to open. Down here in the wheel pits one could not hear himself speak, let him shout as loud as he pleased, so all the conversation I carried on with the workmen was done by writing questions on a piece of paper, to which they answered by nodding or shaking the head. Everything seemed weird in this rock-walled pit so far below the surface. Electric lights are provided, but the flaming torches cast a lurid glare over the men, who wore rubber coats, boots and hats. The water was continually dropping down as it came seeping through the walls, and in some places it was quite deep on the plankfloor. I had on my mackintosh, and had borrowed a cap from one of the men, and, with collar and trousers turned up, enjoyed it hugely. All machinery is fascinating, but this is the most fascinating place I had ever been in, and I walked around shouting to the men at the top of my voice. But nobody knew it, for that fearful screeching sound drowned out everything else. It was unlike anything I had ever heard before. It was too high to be a musical note, and can only be described as a screech or howl. And there was no let up to it. There were several explanations offered by those who heard it, and here are two, which may be taken for what they are worth. The first was that the holes cut in the hollow sections of the shaft for balancing purposes made of it a flute, and so produced the sound. The second, and to me the more rational explanation, was that as the guide wheel had 36 buckets and the turbine wheel 32, there would be produced at each revolution over 1100 vibrations, which at four turns per second might produce the required pitch. At any rate, the noise down below was horrible, while up on top scarcely a sound could be heard.

The shaft which transmits the power to the dynamo above is of steel, hollow, and 38 inches in diameter, except at the bearings, where it is reduced to 11 inches, and is solid. A thrust bearing is provided at the top, to take the difference between the weight of the revolving parts and the upward thrust of the water. The latter is calculated to amount to between 149,000 and 155,000 pounds, and depends on the quantity of water the turbine is using. The weight of the revolving parts is 152,000 pounds, so that the thrust-bearing has only about 3000 pounds to provide for.

The top of the wheel-pit is arched over with solid masonry, on which the foundations of the dynamo rest. The armature is stationary, and is supported by a cylindrical casting through which the shaft passes, guided by two bearings. The armature core is built up of sheet steel stampings, there being eleven segments to the circle, and each placed so as to break joints. The core is held together by 66 nickel steel bolts, and the conductors are imbedded in 187 slots around the periphery. The external revolving field is made up of a ring-yoke with internally projecting pole-pieces. The ring is of nickel steel, nearly twelve feet in diameter, and was forged from a single ingot weighing 120,000 pounds. It is supported by an umbrella-shaped casting called the driver, which is keyed to the tapered top of the shaft, and has the ring bolted to its periphery. The driver is provided with openings at the top, and so arranged with ventilating scoop-shaped funnels that a powerful upward draft will be created through the machine. This is necessary, as heat must be dissipated at the rate of 100 horse power. At 250 revolutions the peripheral speed of the ring is 9300 feet per minute, and the tensile stretch 5052 pounds per square inch. The designers calculate that it will be impossible for the wheels to exceed a speed of

* Exclusive Correspondence of THE ELECTRICAL JOURNAL.

400 revolutions to the minute, when the stress would be 13,000 pounds per square inch. But as the elastic limit of the steel used in the ring is 48,000 pounds per square inch, there is still a large factor of safety. It may be interesting to state that at 800 revolutions per minute the ring would burst, but the circumferential velocity would then be something like six miles per minute.

From the dynamo four cables lead to the big switches operated by compressed air, and convey the two-phase currents to the bus bars, whence it can be distributed to the users. The switches open all four wires at once, and are provided with non-arcing contacts, so that when the circuit is opened with the full load of 5,000 horse-power on the spark is no greater than with 25 amperes of direct current at 110 volts. Special volt meters, ampere meters and watt meters were designed for this plant and designated as the Niagara type. The whole electrical plant may be looked upon as a magnificent piece of execution, and as embodying the highest skill on the part of the designers. The conditions imposed were most trying, but each difficulty was met and the plant stands to-day as a model in every way. There may be a difference of opinion as to the present value of this immense work, as to its safety as an investment, but there can be nothing but praise for the engineers who designed it and for those who carried out the designs. We were all greatly pleased that we should have an opportunity to see the plant, and it was quite late in the afternoon when we took the carriages for the Pittsburg Reduction Company's works. There we examined the big rotary transformers which deliver direct current at a pressure of 160 volts, each machine giving 2,500 amperes. There are at present four in place, but the ultimate capacity of the building is eight. The 2,200-volt current is transformed in two static transformers, one on each phase, to a pressure of 115 volts and delivered at once to the motor end of the rotaries. The direct current bus bars are flat copper bars, 3 inches high and half an inch thick, and we had the pleasure of seeing them disappear through bushings in the wall. We were not admitted to the furnace room, and as the current had not been turned on yet there was nothing more to be seen.

W. E., Jr.

Trenton, N. J.

A LIFT BRIDGE ON THE CHICAGO ELECTRIC ELEVATED.

That the applications of electricity are readily able to surmount every difficulty that appears in the execution of practically every enterprise of whatever magnitude is shown by the interesting illustration of the lift bridge recently erected over the Chicago river by the Metropolitan West Side Elevated Railroad Company—the new electric elevated road of Chicago. In this instance the line current, or rather third rail current, not only operates the trains but is utalized for operating the left bridge and the constant use that it is put to from the continual passing of craft on the Chicago river has demonstaated its worth most thoroughly.

ELECTRIC LIGHT CHEAPER THAN CANDLES.

In San Rafael, recently, some ladies who had been appointed managers of a lawn party to be given by the church, were dismayed on learning that the money set apart for buying candles, was not nearly sufficient to enable the grounds and building to be properly lighted, and why the ladies appealed to the San Rafael Gas and Electric Light Company to help them out of their dilemma is not clear, but they did so, the place was beautifully lighted, and a surplus remained in the "candle" fund.

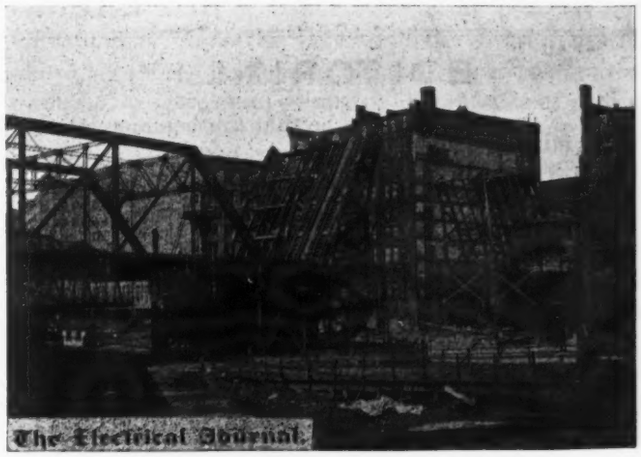
"AS OTHERS SEE US."

"Let me congratulate you—or rather the electrical interests."—F. Benedict Herzog, Ph. D., New York.

Mr. Low's new paper, The Electrical Journal, has appeared. It is attractive in appearance and contains much of interest to electrical men.—Pacific Electrician, San Francisco.

"I * * shall hope to see in your publication from time to time, articles of value on the subject [of electricity as a fire hazard.] I am sure Mr. Low can contribute materially to the literature of this branch of insurance work."—W. J. Jenks, New York.

William Henry Preece, F. R. S., Engineer-in-chief, General Post-office, London, writes in receipt of the initial number of The Electrical Journal: "I haveread your article on the 'Express' system with much interest," and "I quite long to come over and see it work."



A Lift Bridge on the Chicago Electric Elevated.

We welcome to our exchange table The Electrical Journal, a paper which will be published monthly at San Francisco. The editors are F. A. C. Perrine and George P. Low, which fact in itself is enough to insure a publication of the very highest class.—Street Railway Review, Chicago.

The Electrical Journal, edited by F. A. C. Perrine and Geo. P. Low, and published at San Francisco, appeared for the first time July 1st. It is claimed to be the newest electrical publication in America, which is certainly well founded. The publication is neat and attractive in appearance and its reading pages contain much that is of interest. The editors are both well-known to the electrical fraternity.—Electrical Industries, Cnicago.

The first number of The Electrical Journal of San Francisco is out. This is Geo. P. Low's paper, and its pending appearance was mentioned in the Western Electrician, several weeks ago. It is a monthly, of handsome appearance, and from the quality of the first issue gives promise of being an important factor in the electrical advancement of the Pacific Coast region. The editors, Mr. Low and Dr. Perrine, are to be congratulated.—Western Electrician, Chicago.

The Electrical Journal.

An Illustrated Review of the Industrial Applications of Electricity, Gas and Power.

EDITED BY

F. A. C. PERRINE, D. Sc., and GEO. P. LOW.

Subscription . . . . One Dollar per Year in Advance.

Advertising Rates Furnished on Application.

PUBLISHED MONTHLY BY GEO. P. LOW,

303 California Street . . . . . San Francisco.

LONG DISTANCE TELEPHONE, MAIN 5709.

[Entered as Second-Class Matter at the San Francisco Post Office.]

VOLUME I. AUGUST, 1895. NUMBER 2.

ANNOUNCEMENT.

Beginning with the September issue and for reasons which will appear therein, the title of this publication will be The Journal of Electricity.

GEO. P. LOW.

EDITORIAL.

POWER TRANSMISSIONS OF THE FUTURE.

It may be that the commercial success of the power transmission plants now being installed at Folsom, Niagara and other places, will create such a prestige for alternating current machinery in the minds of inventors that we will never again see a great direct current undertaking for the purpose of long-distance transmission. However, it is wise to bear in mind that the development of alternate current power transmission in this country is carried forward by the weight of the authority of two great manufacturing companies; that there are problems still awaiting practical solution which may be prejudicial to the economy of these plants; that successful long-distance direct current transmissions at high voltage are at present installed in Europe and California; that five hundred volt transmissions of ten or twelve miles are a commercial success in this country in connection with many electric railroads; and that recent improvements in the design of direct current machinery point to the possibility of the generation of higher voltage than has heretofore been attempted in large units.

Constant current generators as large as 100 K. W., producing a current of ten amperes, have been in successful operation for the past two or three years, but it is undoubtedly hazardous engineering to furnish four or five hundred horse-power to be distributed small motors by the means of such machine. Neither does the motor-transformer operate at an advantage on a circuit in which the maximum current is ten amperes and the voltage is kept within the extreme limit of 20,000 volts. On the other hand eight to ten thousand volts seems to be the limit where the current rises to forty or fifty amperes, even when generators in series are employed. While transmission by the means of a direct current is placed by these difficulties, which seem to limit the power transmitted over a single line to 250 or 300 K. W., alternating current transmission has already seen the operation of 3,750 K. W. units, and it has been announced that several of such units are to be run in parallel.

But possibly the immunity from accidents and need of repairs, said to be possessed by alternating current machinery, may be only a fancied security.

We can see the sparks at the commutator of a direct current generator, and we are able at once to perceive when they are destructive and at what time they are harmless; furthermore, the damage they may do is not likely to be instantaneous, but no man can tell when some accident along the circuit has occasioned surgings in an alternating machine, nor is mortal quickness sufficient to prevent the damage which may be accomplished by such surgings. Yet up to the present time resonance has not proved to be an insurmountable difficulty, whereas sparking at the brushes has absolutely prevented the introduction of direct current machines of large size when high voltages are to be employed.

This limitation of the direct current machine has not been touched upon in any of the discussions of either Sayres' compound wound armature in England, or of Ryan's field compounding for armature reaction in this country. The experiments of both these designers have been conducted with low voltage machines, and it has been very properly objected that in face of practical machines running sparklessly at five hundred volts and currents as high as two or three hundred amperes, no great extra expense is reasonable in order to gain sparkless commutation at lower voltages. It may be true that those of the Sayres or Ryan construction are some tenths of a per cent. more efficient than machines of the ordinary design running sparklessly, but the advantages of a slight gain in efficiency is insignificant in comparison with the possibility which these designs present of the construction and operation of large direct current units distributing power at a great distance to rotary transformers in parallel, feeding low pressure networks in direct competition with the modern multiphase alternating current systems.

Should either of these designers accomplish the generation of high voltages by the means of large direct current units, the expense of the maintenance of a commutation under ordinary wear will undoubtedly sink into insignificance in comparison with the lack of complication of other details in the system. The problem of insulation will be simplified; capacity, resonance and self-inductive effects will be eliminated, and we will see the direct current taking its place and doing its proper share of the long-distance transmission which is still remaining to be accomplished.

A VITAL ISSUE.

The signs of the times are clearly set forth in the struggle now going on between the Oakland, San Leandro & Haywards Electric Railway Company and the Southern Pacific Company for the control of the traffic between San Francisco and Haywards. It is the now familiar story

of the trolley invading the domain of the steam road, not only in its passenger business, but in express matter and freight as well, and present indications are that upon the shoulders of the Haywards electric road will fall the burden of demonstrating both in a practical and in a legal sense, that electric railways can wrest a goodly portion of traffic from steam lines. But more than this, it appears necessary that the courts should establish the fact that electric street railways are a new development in the way of transportation, which cannot be reduced to the equality of steam roads. They are a distinct creation, which owes its origin to public demand.

Viewed from an independent standpoint and broadly, it certainly seems as though every advantage was arrayed on the side of electric traction. With good road beds and unsurpassed equipments, with running time schedules practically equal to those of the steam roads and with the great convenience of being able to land one at his very door, it is hardly probable that the travelling public will care to drop the new method for the old. The Postoffice Department was quick to perceive these disadvantages, and months since adopted the electric service for the carrying of mails. Now, in the case of the Haywards electric road, an express system has been instituted for the carrying of all manner of express matter, and as a result the mighty corporation that has dominated the interests of California is evidently determined to see just how far the public will stand by the steam roads, but although the old service was vastly improved by establishing more frequent trains and by bettering the equipment, still it preferred the electric road for local travel. Finally, the State Board of Railroad Commissioners claims that the electric line comes under its jurisdiction and under this contention has requested the company to report to it. This the latter has refused to do and at present it appears certain that the question will find its way to the courts for settlement. The outcome of the contention will exert a far-reaching influence, the importance of which must not be underestimated.

READ YOUR FIRE INSURANCE POLICIES.

An insurance policy is a contract drawn between two parties whereby the first party, in return for proper consideration, agrees to insure to a pre-determined extent the party of the second part against loss or damage by fire occurring to specifically described property of the second party. A policy is, in brief, a clearly drawn, specific contract, the standard form of which has been not only sustained by the courts time and again, but which has, in the States of New York, Pennsylvania, New Jersey and Wisconsin been drafted under legislative surveillance. To disregard its stipulations, therefore, is to violate the terms of a contract, and the astounding fact is brought out during the adjustment of practically every fire, that shrewd, hard-headed business men will oftimes so forget themselves as to enter into a firm and inviolable contract involving the value of their entire business without knowing the terms and conditions of the contract they are entering into. It is quite rational to state that ordinarily the stipulations of a policy might as well be printed in Greek for all the attention they receive.

A man insures much as he would buy a lottery ticket. He does not honestly believe it will be of service or return him any value; still there is the chance that it might do so, and when, as with insurance, the work of a lifetime may be preserved from annihilation, the policy is taken out purely as a means of self-preservation. Insurance is the body guard of commerce, and it is availed of purely in the idea of self-preservation. This being borne in mind, is it not inconceivable that its conditions should be slurred, if not ignored?

There is no disposition to review the terms of a standard form of policy, as a single clause will emphasize the points. A clause reads: "This entire policy, unless otherwise provided by agreement indorsed hereon or added hereto, shall be void * * * if (any usage or custom of trade or manufacture to the contrary notwithstanding) there be kept, used, or allowed on the above described premises, benzine, benzole, gasolene, naphtha, or petroleum, or any of its products of greater inflammability than kerosene oil of the United States standard," etc. Every electric light and power plant in the country has on hand and uses daily either gasolene or naphtha, the presence of which on the premises invalidates all insurance thereon unless special permission for its use has been granted, yet the instances where electric station managers have obtained permits for the use of gasolene or naphtha, as provided in their contracts for insurance, are extremely hard to find. In other words, a vast majority of the electric stations of the country are legally without insurance because of having invalidated their policies.

The tendency of the day appears to be toward specific insurance on the various items constituting the property desired to be covered, but in following this out it must be remembered that under an insurance policy insurance ends where segregation ends. An incident recently occurred illustrating this point in a forcible way. The receiver of an electric railway took out insurance covering a given amount "on engines, boilers and their connections and settings," believing that he had insured all the power plant equipment. The station burned, and in settling the loss it was found that among other items there was no insurance on belting, which was practically the only appliance that was totally ruined. In no way can belting be considered as a "connection" or a "setting" of engines and boilers, hence the insurance companies were under no liability for its loss.

No one expects visitation by fire, but many receive it, so as an ounce of precaution, or more properly, of business prudence, read your policies and understand the conditions of the contract obligations you have agreed to abide by in case of fire.

Literature.

TRANSMISSION LINES, by A. V. Abbott.

It is a great pleasure to have been given the opportunity of looking over the proof sheets of such a book as A. V. Abbott's forthcoming volume on "Transmission Lines." Recently a writer in one of the electrical journals complained that no book had been issued on engineering problems of line construction, stating that the reason was probably to be found in the fact that the construction had been intrusted to men of practical experience rather than to theoretical designers—to linemen rather than to engineers. This may, perhaps, have been true in the construction of most telegraph pole lines, or, it is said, may account for the greater or less disorganization of telegraph service after every heavy windstorm, and undoubtedly explains the waste of thousands of dollars in faulty underground construction by most of the electric light and railroad companies throughout the country. Mr. Abbott's book is the book of an engineer and treats the problem as one of engineering.

The telephone companies were one of the first to recognize the importance of erecting their pole lines in such a manner that their service should be continuous in spite of climatic conditions, and of doing their underground construction for permanence rather than for simple cheapness. With the expiration of the Bell telephone patents and the termination of the Western Union contract we are bound to see a reorganization of both the telephone and the telegraph business throughout the country, and in the forthcoming contest we will undoubtedly see fruits of the efforts of the engineer where the inventor and lineman have heretofore held sway.

The lead in the competition will be taken by the company which will give the best service and at the least cost, which means the best apparatus, the best lines and the least repairing, all of which require the best and most thoroughly trained engineers.

THE LAW OF INCORPORATED COMPANIES, by Allen R. Foote and Chas. E. Everett, 3 vols., 8vo., 2930 pages, sheep. Cincinnati, 1892-93. Price, $15.00 For sale by the Bancroft-Whitney Company, San Francisco, and The Electrical Journal.

The trite adage that "Any man who is his own lawyer, has a fool for a client," is not to be impeached, but in no way will a belief in the precept preclude one from posting himself regarding the general laws which govern the business he is engaged in, and in fact, the business manager of corporate interests, who does not keep himself well informed as to fundamental legal points, is remiss in a very important item. The volumes presented expound the laws of the various States and Territories of incorporated companies operating under municipal franchises, such as gas, electric light and power, telephone, street railway and water companies; hence, they throw the light of legal knowledge upon the proper methods of procedure in the organizing, incorporation, powers, liabilities, franchises, and general management of commercial interests that are generally electrical in character. Of the author, Mr. Allen R. Foote is well known to electrical interests, because of his work on the "Economic Value of Electric Light and Power," his special agentship for electrical industries in the United States census, and his membership of the American Institute of Electrical Engineers. Aside from Mr. Chas. E. Everett, A. M., LL. B., who is editing attorney for the work, a resident attorney in each State has been appointed as co-editors, among whom are noted such prominent personages as William A. Blount, of Florida; Charles H. Aldrich, ex-Solicitor General of the United States, of Illinois; Chief Justice Henry M. Blake, of Montana; Anthony S. Keasbey, of New Jersey; James W. Eaton, of New York, and Judge George H. Williams, of Oregon. Indeed, the names associated in the compilation of the work, alone, guarantee its thoroughness and accuracy. It is, in brief, a work that no lawyer or manager can afford to be without.

ON THE DEVELOPMENT AND TRANSMISSION OF POWER, by Wm. Cathorne Unwin, F. R. S., London, 1894. Published by Longman, Green & Co.

The transmission of power to a considerable distance has only attracted much public attention in this country since the introduction of electricity as a means of energy transformation. In consequence, even our engineers are in danger of forgetting that for many years thousands of horse-power have been economically distributed through New York by the means of steam pipes laid in the streets; that hot water distribution was for a time successful in Boston; that natural gas differs but little from a fuel gas, which it is possible to manufacture cheaply, and that long distance hydraulic transmission has furnished the power for mining millions of dollars worth of gold in California. It is true that each of these examples is the special solution of a special case, but it is also true that such solutions are the essence of successful engineering, and it is wise to look over the means already at hand for the development and transmission of power, before we decide that any one is necessarily suitable for a given case. The first impression on reading Prof. Unwin's Harvard lecture on "The Development and Transmission of Power" is one of surprise that an engineer of high standing and wide attainments can be found who seems to believe that power may be transmitted in many cases more economically by the means of high pressure water or compressed air, than by the means of electricity.

And again, one is surprised by the magnitude and success of the power plants described, using those methods which are successfully installed in Europe. There is much food for thought in all of this, and an engineer can scarcely afford to neglect the consideration of many of the advantages which this book calls to our attention, present in other means of distribution, even when he may be considering the installation of an electric plant. The generation and distribution of power is here considered as a whole in a manner difficult to express more completely in so compact a form: and central station engineers may find in the chapter on the "Condition of Economy and Waste in Steam Engines," "The Cost of Steam Power," and "The Storage of Energy," many of the conditions clearly expressed, which are useful in determining the necessary arrangement, and methods of handling apparatus in order to reduce the great consumption of coal in even our best equipped stations, which has been reported by the committee of the National Electric Light Association. In the treatment of hydraulic motors one is impressed by the necessary inefficiency of the common hydraulic elevator, using, as it does, the same amount of water for all loads, and it seems a small wonder that the introduction of a successful electric high speed elevator has been followed by a very wide spread use. The problem of a small motor which shall use hydraulic power economically, will hinder greatly this type of transmission wherever the cost of water pumped becomes a serious consideration, as has been shown by the experience gained at both Holyoke and Geneva. Even where water power is abundant, and the cost of pumping low, there yet remains the problem to be solved whether it is not finally more eco-

nomical to install electric machinery which will generate current directly available for other uses than the development of power, and by the increased efficiency of motors save much of the expense of mains and turbines in the original water power installation.

The complete description given of telodynamic or wire rope transmission confirms one in the belief that save for small powers at short distances, such as from one section of a works to another, there is little likelihood that this method will be extensively used in the future. It is unfortunate, however, that no mention is made of the telodynamic transmission at the Calumet & Hecla mine, in which a rope has been for many years successfully run at 12,000 feet per minute. It is not difficult to perceive that transmission by the means of compressed air has received Prof. Unwin's greatest attention and favor. We already know that very few pneumatic plants have been displaced in mining, and it is an open secret that for deep mines the economy of working is considerably greater with compressed air than with electricity, in spite of the fact that neither the compressors or air drills are often worked under the greatest conditions of economy. The two chapters on the "Transmission of Power by Compressed Air," and the "Theory of Air Transmission" discuss very carefully the problems of the compressors, mains and motors, taking into account all the subsidiary losses of energy which are involved, and one is forced to the conclusion that a high efficiency of transmission and distribution is easily attained by the means of compressed air.

The economy of plant is not by any means so completely established, as it is difficult to acknowledge that the cost of installation of machinery is less than with electricity, and one would hardly let the statement go unchallenged that one-fourth pound of coal per horsepower hour used in reheaters, is an inconsiderable quantity.

The distribution of power by steam and gas is not as fully treated as the cases already cited, the chapter on steam distribution being taken almost entirely from Dr. Emery's published writings, while the distribution of heat by the means of exhaust steam is entirely neglected, though this has become a very important adjunct to many power stations installed in this country. In many cases such a distribution is claimed to be of more value to the financial economy of a station than the availability of water for condensation.

We are inclined also in this country to look for a substitution of fuel gas for natural gas in power transmission, and it is disappointing to find in Prof. Unwin's book so pessimistic a view taken of the future possibilities of the economical production and distribution of producer gas.

The two chapters on "Electrical Transmission," and the chapter on the "Utilization of Niagara Falls" possess a peculiar interest on account of the position of Prof. Unwin as one of the original advisers of the Niagara Falls Power Company. The history of electrical power transmission is only beginning to be written, and it is painfully evident in this book that to the general engineer there is but little data available for estimating the cost of construction, maintenance and operation of an electrical transmission plant. Prof. Unwin has hardly advanced beyond the position of Prof. Forbes' lectures on "Electrical Distribution," while in citing and applying Kelvin's law he makes the serious common error of neglecting the condition that the solution only holds for the current being considered a constant. Comparing the power delivered by the complete list of long distance electrical power transmission given by Unwin, and the capacity of the plants installed since his data was collected, one is impressed with a very practical proof of the efficiency of this system of power transmission.

In the chapter on "Niagara" we have a clear outline history of the undertaking, and it is a relief to read an account of the Niagara Company, its commission and engineers, which is free from the ill-feeling and hard names which have been used so generously in connection with this plant. The volume as a whole is a most valuable addition to the literature of central station construction and power distribution, and presents much matter which no engineer can afford to neglect.

SPECIAL AGENTS' ELECTRICAL HANDBOOK, by A. M. SCHOEN, Assc. Member A. I. E. E., Electrician South-Eastern Tariff Association. Atlanta, Ga., 1894, 82 pages, 16mo, leather. Illustrated. For sale by THE ELECTRICAL JOURNAL. Price, $1.00 each, post free, with liberal discounts for large orders.

This little book, which was designed for the guidance of special agents for insurance companies and may be read with advantage by all electricians, deals with electricity in its bearings upon insurance inspections. The book was printed by the South-eastern Tariff Association, and proved to be so popular that the small edition issued was soon exhausted. The author, with the consent of the association has transferred his copy-right to The Spectator Company, which has issued a new edition, *enlarged and improved.* Mr. Schoen has made many and important additions to the Electrical Hand-Book: which also contains numerous illustrations of electrical appliances and descriptions of imperfect work not in the first edition, together with full instructions to enable inspectors to ascertain the hazards of all electrical machinery and appliances.

THE PACIFIC COAST GAS ASSOCIATION.

The third annual meeting of the Pacific Coast Gas Association was held at San Francisco on July 16–17, during which the following papers were read and fully discussed: "The Economy of Small Works," John Clement; "Welsh Anthracite Coal," John L. Howard; "Treatment of our Customers," O. M. Gregory; "One Year's Experience with Wellsbach Burner," E. C. Randall; "Calcic Carbide," E. C. Jones; "Technical Gas Analysis," J. Bryant Grimwood, "Producer Gas," H. E. Adams.

The retiring President, Mr. C. W. Quilty, of San Jose, also delivered an interesting address, after which the business of the association was transacted. An important action taken was the selection of the American Gas Light Journal as the official organ of the association, in which publication the proceedings of the association may first appear.

At the second days session the following officers were elected for the ensuing year: President, E. C. Jones; Vice-President, F. H. Eichbaum; Secretary and Treasurer, John A. Britton. These officers will constitute an Executive Committee and an Advisory Board. The directors elected are as follows: O. M. Gregory, San Jose; G. W. Wilson, Vallejo; C. O. G. Miller, San Francisco; B. U. Steinman, Sacramento; and S. B. Cushing, San Rafael.

The social features of the convention proved most enjoyable, the first of which was the superb banquet held at the new Delmonico on the evening of the first day of the session. After adjournment on the second day, there was an excursion on the bay and luncheon at the North Beach station of the San Francisco Gas Light Company. In the evening a theater party was held at the Columbia, which concluded the most enjoyable and profitable session yet held.

THE DENVER CONSOLIDATED TRAMWAY COMPANY.

The Company of which the present system is the outgrowth, was organized February 5, 1885, as the Denver Electric and Cable Railway Company, the earliest effort of which was the operation of a conduit system of electric railway on Fifteenth street, in Denver, Col. Mr. Rodney Curtis, now President of the Tramway Company, was the first manager of the original company. On May 4, 1886, the Tramway Company was organized and shortly after built and placed in operation about twelve miles of cable road, constituting the Broadway, Colfax and Fifteenth Street lines, the latter of which displaced the conduit electric line referred to. The South Broadway Electric line, which was put in operation on Christmas day, 1889, was the first trolley road operated by this company, and to-day the Tramway Company has in operation eighteen lines, all being electric, as the cable roads were abandoned in 1893. These lines are the Broadway, Colfax, Nineteenth, Twenty-second, Stout, Lawrence, South Tremont, Eleventh, Harmon, Pearl, University Park, South Broadway, Park Hill, Berkeley, Rocky Mountain Lake, Agate, Ashland and the Riverside line, making in all 99.29 miles of single track. The motors used are of the Westinghouse, Thomson-Houston and General Electric types.

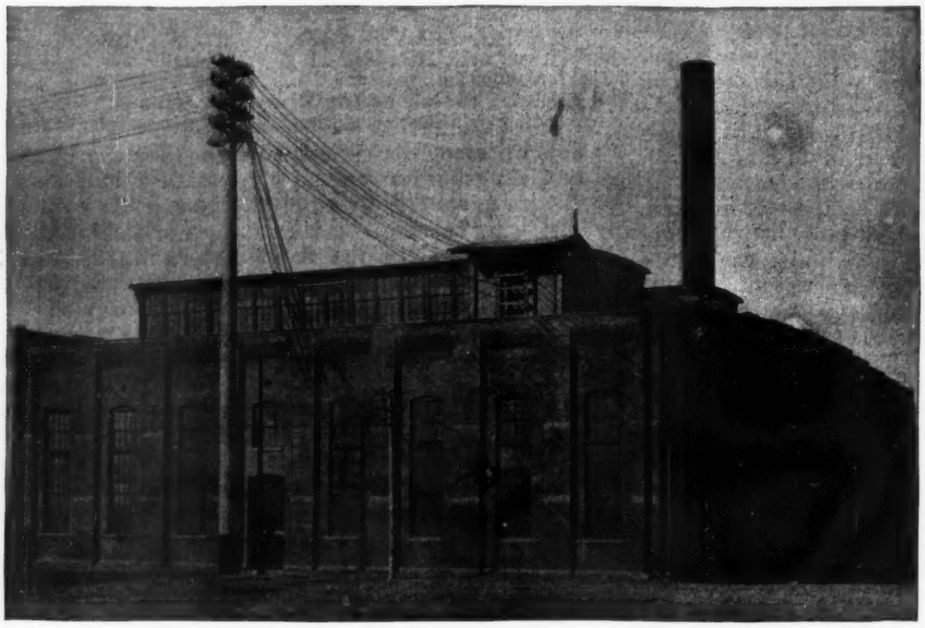


FIG. 2.—THE DENVER CONSOLIDATED TRAMWAY COMPANY.

The Grand Avenue Station, the interior of which is shown in Fig. 1, is mainly equipped with type D62 T. H. railway generators, there being also one 250-kilowatt General Electric multipolar generator. All machines are driven from a counter-shaft, operated in turn by a large twin Corliss engine. Either of the railway lines can be operated from this plant.

It was at this station that one boiler of a battery of twelve tubulars exploded on January 30th last, but the accident, though serious, did not materially delay operations, as in a few days the plant was again in operation by steam supplied from locomotives that had been run up alongside the station

The Blake-street Station, on Blake street, near Thirty-second, and which at that time carried most of the load, contains two General Electric multipolar 500-kilowatt generators, and also one Westinghouse 500-kilowatt multipolar generator. These dynamos are each belted direct to Hamilton Corliss, or Reynolds Corliss engines, and together with the necessary boilers, etc., constitute the plant. There is, however, room for two more 500-kilowatts units, and at present it appears as though a 500-kilowatt Siemens-Halske direct connected generator would be placed in the near future. The switchboard is of white marble, with phosphor bronze trimmings, and so arranged that it may be extended to almost any capacity. Water lightning arresters are used behind the switchboard.

The Tramway Company has several well-stocked car-barns, and all of its equipment is of excellent design and finish, both for summer and winter travel, as will be apparent from the accompanying illustrations. Since its inception the road has been under the superintendency of Mr. C. K. Durbin, to whose ability the general superiority of the equipment and service is largely due. Without doubt Denver owes much of its growth and prosperity to the enterprise of the Denver Consolidated Tramway Company.

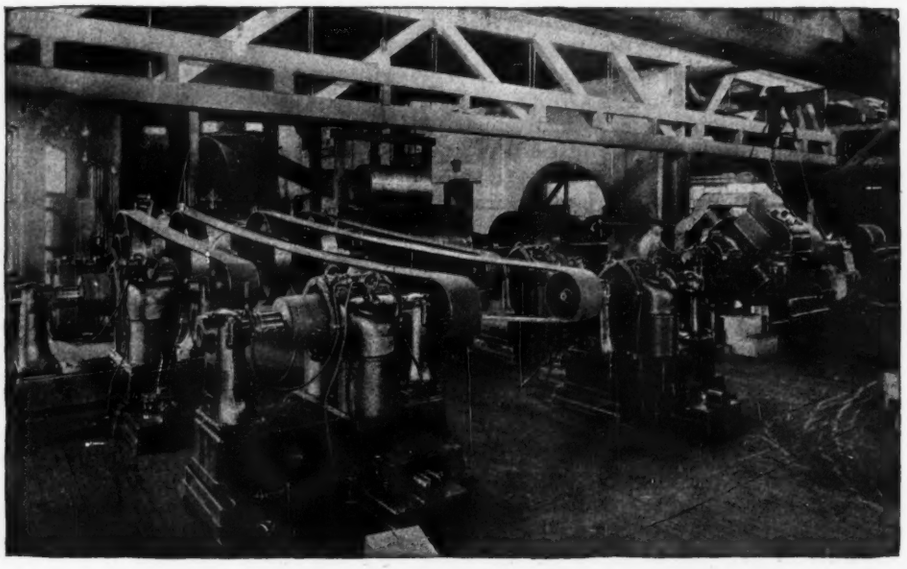


FIG. 1.—THE DENVER CONSOLIDATED TRAMWAY COMPANY.

ELECTRIC POWER TRANSMISSIONS—ACTUAL AND PROSPECTIVE.

The month just closed will prove a memorial one in electrical circles of the Pacific Coast, if not by the world, not only because of the successful starting of the Folsom-Sacramento plant, but because of the awarding of contracts for the erection of other yet more interesting power transmissions.

At 4 o'clock in the morning of July 13th, the people of Sacramento were roused by the booming of 100 guns, the signal which had been arranged to announce the successful transmission of power from the Folsom dam across the American river to Sacramento river, a distance of 22½ miles. This installation is in some respects the most noteworthy ever undertaken. It operates at an initial potential of 11,000 volts, its four generators have a capacity of 750 kilowatts or about 1000 horse-power each, and are, therefore, the largest three-phase dynamos ever constructed. The entire equipment is, or when completed will be in duplicate, and at present a double pole line has been erected over the entire distance, but only one generator is in use. The present condition of the plant is largely temporary regardless of statements published to the contrary and a description of it at this time would be premature. But a single generator is running, owing to the breaking of a temporary dam and the weting of a second dynamo that had been sent out. At Sacramento, a 500 horse-power, three-phase motor is driving two Edison bi-polor and one General Electric street railway generator and also a 10 horse-power motor for operating a toboggan slide that the Central Electric Railway has erected in East Park. In fact, the necessity for obtaining power for operating the Central street railway system, which is owned by the Sacramento Electric Power and Light Company, compelled the starting up of the Folsom transmission before it was ready. This statement of the actual condition of affairs, however, does not detract in any way from the value of the enterprise or its influence upon the development of similar enterprises, but, to the contrary, enough has been accomplished to satisfy the most exacting as to the feasibility of the scheme and the thorough practicability of the methods and apparatus used.

FIG. 3—CAR BARNS OF THE DENVER TRAMWAY CO.

Following close upon the starting of the Folsom transmission comes the announcement recorded in the news department of this paper, that the General Electric Company has secured the contract for transmitting 2,500 horse-power a distance of 14 miles from the big Cottonwood dam to Salt Lake City, and, most important of all, that the same Company has accepted a contract under which it agrees to deliver 1000 horse-power in Fresno, Cal., from a fork of the San Joaquin, thirty-five miles distant. This plant will probably be in operation early in January. In Southern California many ambitious projects are under way and will be installed if substantial backing is to effect it. Principal among these are the Power Development Company, of Bakersfield, which has issued specifications and is now receiving propositions, as described elsewhere.

Over topping all, however, is the announcement just made of a gigantic electric power transmission scheme in which the organizers have very dextrously arranged so that they will have as generating power the water from the immense debris dam soon to be built at Deguirie, six miles above Marysville on the Yuba river. Acting upon the recommendation of the California Debris Commission the last legislature appropriated $250,000 for the erection of a mining debris dam at Deguirie, which amount it is believed will undoubtedly be increased by an appropriation of $ 350,000 from Congress. The Deguirie dam will develop 70,000 horse-power, the right to use which has been secured by Assemblyman R. I. Thomas, of Nevada county, who states that he has sufficient California capital behind him to complete the plans.

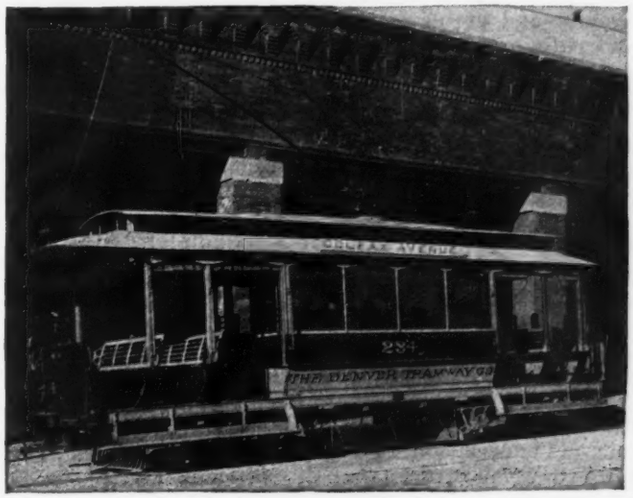


FIG. 4—THE DENVER TRAMWAY CO.

Electro-Insurance.

THE LESSONS OF A FIRE.

It appears from the report rendered by George P. Low, appraiser for the various insurance companies represented in the fire which destroyed the power house and car barn of the Seattle (Wash.) Consolidated Street Railway Company early on the morning of June 20th last, as described in the last issue of this publication, that in addition to a large amount of supplies, the burned station contained the following dynamos, with their usual wiring and switchboard appurtenances:

7, Type D82, 80 horse power, Thomson-Houston, 500-volt railway generators.

2, 60-kilowatt Edison, 500-volt railway generators.

1, 60-kilowatt National, 500-volt railway generator.

2, 1000, 16-candle power, National alternating incandescent lighting dynamos, with exciters.

2, 50-light Western Electric arc lighting dynamos.

25, Electric street railway passenger cars and equipments, and

1, Electric wood hauling car.

The list given represents practically every type of dynamo-electric machinery used, as it includes 500-volt direct current generators, 2200-volt alternating current generators, and 2500-volt arc lighting dynamos. The equipments of the electric cars, though serviceable, were mostly of an inefficient type, no longer manufactured or for sale, and which, therefore, would not find a ready market if rebuilt. The seven D62 railway generators and the electric cars and supplies named, which were the property of the Seattle Consolidated Street Railway Company, alone are considered in the report.

The dynamo and engine room was located on the ground or basement floor, and as the fire originated or burned most fiercely in the car barn, constituting the upper story, the injury to the power plant was principally due to water, the falling of car equipments, etc., and of burning timbers and cars. From information and evidences at hand, it is clear that the efforts of the Fire Department were exerted in the direction of keeping the fire from reaching the power plant as far as possible, in order to accomplish which, several powerful streams were kept playing upon the dynamos, and in the dynamo and engine room during the fire. As a result, and although the building was entirely destroyed, the dynamos were thoroughly soaked and buried in burned debris. At the outset the prospect of saving the generators seemed remote, but it transpired that the method adopted by the Fire Department in playing continuous streams of water upon the dynamos and in the dynamo room, was to be highly commended.

The task of drying out and testing the generators, continues the report, proved long and laborious, not only because of the almost infinite care and watchfulness that must be exercised to detect any adverse symptom that might develop during the process, but because of the necessity of using the crude and more or less unsatisfactory means at hand for prosecuting the work. On June 28th, three D62 generators had been dried out and tested, and set up and put in operation under the direction and supervision of the Insurance Appraiser. The third day following, a fourth generator was placed in serviceable condition and put in operation, and on July 3rd, the Consolidated Company, through its proper representatives, released the insurance companies from further liability on these dynamos. The fifth dynamo was placed in service July 4th, but the armatures for the remaining two dynamos proved refractory, and despite the most careful treatment they burned out; the first while under potential test, and the second on July 9th, after having been in actual service but five hours the previous day.

The Appraisers' report shows the sound values of these seven D62 generators to be $10,500. The cost of placing the same in service again in first-class condition, and including an item of $400 for labor (which local conditions rendered excessive) was $1,306.15, or 12.4 per cent. of the sound value. Under ordinary conditions regarding labor, this ratio would have been reduced to almost 8 per cent.

The switchboard was totally consumed, except the circuit-breakers, which were rewound and remounted at a cost of $7.50 each, and are now in regular use. The sound value of same was $240, and the damage $30. The car equipments, electrical and other similar materials and supplies were destroyed beyond reclaim, except as junk.

Circumstances indicate that the fire originated either through spontaneous combustion or incendiarism, but certain it is that the fire was not due to electricity, as, when first discovered, it was in a portion of the car barn that was not lighted by or wired for electric lighting. It was the invariable practice to remove the trolley wheel from the trolley wire when the cars were in the barn, hence, there is no probability that the fire was caused by defective electrical equipment in a car. The floors were of rough 2-inch planking, with cracks between planks, the ceiling below was finished with $\frac{7}{8}$-inch tongued and grooved stuff; the floor had been soaking oil for three or four years, and although orders had been given regarding the disposal, etc., of oily waste, it is possible that such orders were disregarded and that spontaneous combustion resulted therefrom. On the other hand, the fire when first seen, was in the immediate vicinity of a doorway leading out of doors, and which was never closed, as it had no door. Regardless of orders to the contrary, the car barn was unoccupied at the time of the fire, as the night barn foreman and his helper had, in violation of instructions, taken out a special car to take another employee home. The engineer and dynamo tender were at their work in the engine room; it was about 1 o'clock in the morning, the car barn was vacant, all its doors were wide open, and an incendiary would have found a most favorable opportunity. No direct evidence of any nature is available, hence, it is impossible to reach a conclusive opinion regarding the origin of the fire.

The report offers the following comments as the principal lessons of the fire:

1. Railway generators are not susceptible to great injury from water alone, if not in operation when wetted,—the average damage from such cause being, approximately, 12.5 per cent. of their value.

2. The injury to railway generators, by fire and water together, will not ordinarily exceed approximately, 50 per cent. of their value, if the frames and shafting remain sound.

3. The losses on switchboards and electrical supplies of all descriptions, if burned, will be practically total.

4. The losses on switchboards and electrical supplies by water, will rarely exceed 25 per cent. of the sound value of any article.

5. The water damage to car motors and equipments, will generally average less than 20 per cent. of their values.

6. The damage to car motors, etc., by fire, cannot well be pre-estimated, because of the many forms of motor equipments, and the fact that owing to recent

great advances in the art of car motor building, the type of motors now most in use are neither manufactured or demanded. Forty per cent. of the value would, however, ordinarily be sufficient to rebuild the motor, provided the frame be sound.

7. A careful, competent and conscientious apraisement is necessary on the damage to all electrical machinery injured by fire or water.

8. Since fires in electric power plants spread with such astounding rapidity, sometimes, as in the present instance, enveloping the entire structure in a very few seconds, there appears to be emphatic need for the introduction of reliable thermostatic alarms and automatic sprinklers in such risks, in order, (1), that the engineer may receive instant notification of fire, and shut the plant down, and (2), that the damage may, so far as is possible, be by water rather than by fire.

In conclusion, the report compliments Messrs. B. D. Smalley and B. B. Broomell, for their cordial support in facilitating the work of the appraisers, and to Mr. W. J. Grambs, appraiser for the assured, for the "honorable and fair-minded manner in which he conducted the appraisement on the part of the Seattle Consolidated Railway Company."

METALLIC SODIUM PRECIPITATED BY ELECTRIC LEAKAGE.

The eighth fire report of the Electrical Bureau of the National Board of Fire Underwriters, cites an interesting case, illustrating a new source of danger from electric wires, which was recently brought to the notice of the Boston Board of Fire Underwriters by the accidental sounding of an automatic fire alarm in that city. The following account is given by F. E. Cabot, Superintendent:

"For some time past a slight smoke has been noticed issuing from the casing about the electric light wires in the basement, where they enter from the street. When the insurance inspectors arrived and the casing was removed, it was found that a peculiar substance had accumulated about the wires which, when moistened and struck with any hard substance, would give off flashes of fire. All around this point the woodwork was covered with a thick liquid which had dried in places to a white substance resembling discolored salt, and which was slippery to the touch and strongly corrosive. The wood itself was soft and badly discolored.

"The deposit discovered about the wires proved, upon analysis, to be mainly metallic sodium. Metallic sodium is a substance very difficult to obtain except by the aid of the electric current. It is exceedingly combustible and unites so readily with water that its presence in a damp cellar would be impossible under ordinary conditions. When it unites with water hydrogen gas is given off and at the same time a considerable amount of heat is generated. Under certain conditions this heat would be sufficient to ignite the hydrogen gas. Hydrogen gas and air will form an explosive mixture. Hence, the greatest danger lies in the liability of an explosion if the gas should become ignited.

"The explanation of the appearance in a damp cellar of a substance so combustible and unstable in the presence of moisture as metallic sodium, is given as follows: The metallic sodium was undoubtedly the product of an electrolytic decomposition of impure sodium hydrate. This sodium hydrate came from the cement mortar used in laying the brick wall of the basement, upon which the wires were supported. Some of the hydrate may have possibly worked its way through the wall from the cement used in the foundation of the paved street (Washington street), immediately adjacent.

"The electric current which caused the electrolytic action was due to a leak inside the casing, from one of the mains to another. The leak was produced by the action of the sodium hydrate on the insulating covering of the wires. This covering was what is known as "Weather-proof Insulation," which consists of a cotton braiding covered with tar. Such a material is readily attacked by sodium hydrate and its insulating properties destroyed. Moreover, the sodium hydrate itself furnishes a good path for the current when it has once penetrated through the insulation.

"This case is especially interesting in connection with several of the explosions which have occurred in underground conduits, usually attributed to a leak in the gas mains. In the London papers recently it has been suggested that metallic sodium may possibly have had something to do with these explosions. This, however, appears to be the first instance in which the appearance of metallic sodium has been proved and a complete explanation of an actual case given."

PERSONALS.

Dr. F. A. C. Perrine, of the Leland Stanford Junior University, and Mrs. Perrine, are spending the summer vacation on the Atlantic Coast.

Among the prominent guests of the recent meeting of the Pacific Coast Gas Association were Mr. Walton Clark, of Philadelphia, President of the American Gas Light Association; Mr. O. N. Guldlin, of Fort Wayne, President of the Western Gas Construction Company; Mr. Daniel R. Russell, of St. Louis, of Barker, Russell & Co., and Mr. E. P. Callender, of New York, publisher of the American Gas Light Journal.

The University of Wisconsin has conferred the honorary degree of LL.D. upon two men of national reputation on account of their great services in the interest of engineering and the industries. The first of these is Edwin R. Reynolds. of Milwaukee, Wis., designer and builder of the Reynolds Corliss engine. The degree was conferred upon Mr. Reynolds in recognition of his position as an expert of the highest rank and of international authority as a steam engineer, and on account of his remarkable ability and success as a designer and inventor. The second is Don J. Whittemore, of Milwaukee, Wis., Chief Engineer of the Chicago, Milwaukee and St. Paul Railway. The degree was conferred upon him in recognition of his distinguished services in the railway interests of the country.

VAN LEER EASTLAND—IN MEMORIAM.

A scroll was presented and ordered spread upon the minutes of the annual meeting of the stockholders of the Oakland Gas, Light and Heat Company, held on August 5th, as follows:

"In memoriam---Van Leer Eastland died September 8, 1894, after twenty-seven years of active service in the field of gas industries and more than forty years after his first engaging in the work of the San Francisco Gas, Light and Heat Company.

"His was a character worthy of emulation by all who survive him. Zealous in every just cause, loyal to all his trusts, kindly in all his ways, honorable because honesty was his creed, esteemed by those with whom he came in daily contact and respected because of his manliness, it becomes this body, of which he was an earnest member, to pause in its progress and say of him as was said of that noble Roman, 'His life was gentle and the elements so mixed in him that Nature might stand up and say to all the world, 'This was a man.'"

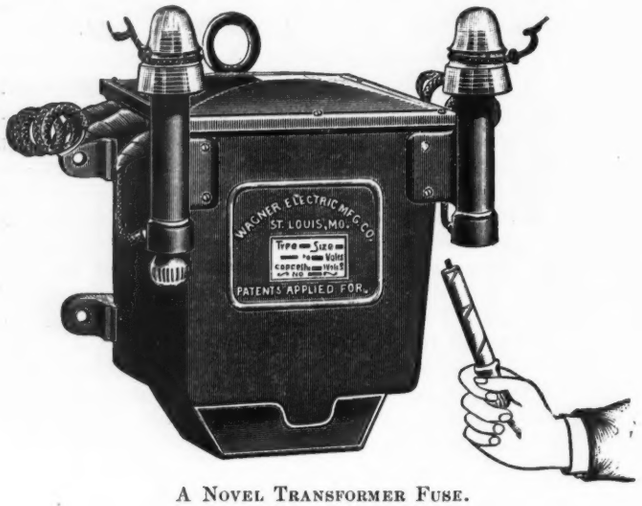
The Trade.

In responding to advertisements in this publication, please mention THE ELECTRICAL JOURNAL.

A DEPARTURE IN FUSING TRANSFORMERS.

The Type D transformer of the Wagner Electric Manufacturing Company marks a new departure in the mechanical design of transformers. The difficulties attending the use of primary fuse cutouts in the transformer box have led some manufacturers to entirely abandon their use in this way, as it seemed impossible to design a fuse block which would not arc at times when the fuse blew on a bad short circuit. This arc would in turn cause a short circuit between the two blocks, and usually burned out the whole cutout as well as the transformer. Appreciating the fact that the transformer box is the best and most convenient place for the primary fuse, the Wagner Company at last provided a cutout which is claimed to meet all possible requirements, with none of the objections or weak points of fuse blocks heretofore used.

The first requirement is a fuse block which can never arc and the second is to have the fuses so placed that they will be separated entirely from each other and from the transformer box, although supported by the latter. The new Wagner fuse plugs are each carried in a separate cast iron shell, attached simply by means of screws to either side of the transformer box. The third requirement is that fuses should be readily replaced without tools of any kind. Not only are no tools of any kind required to remove the Wagner fuse plugs and replace fuses thereon, but there is no cover or lid of any sort to remove or raise in order to reach them. The end of the plug extends below the protecting shell, and three or four turns of this knobbed end releases the plug, which may then be withdrawn.



A NOVEL TRANSFORMER FUSE.

The plug and its insulating shell are not made, as usual, of porcelain, which is very brittle and easily broken, but are turned out of lava, as refractory a substance as any known, and which has about five times the strength of porcelain. With the smallest size fuse plugs, the Wagner Company claims to have repeatedly broken a current of fifty amperes at five thousand volts, without producing an arc, or which left any traces on the plug. They, therefore guarantee these fuse plugs not to arc with five thousand volts.

After securing this perfect fuse cutout, the Company took up the matter of transformer installation, with a view to reducing its cost by rendering the transformer more convenient to hang and connect. By providing cross arm and wall hooks to be bo ted to the transformer lugs, the most convenient hanging of the box itself was obtained and eventually it was determined to attach the wall brackets ordinarily used to the transformer box, thereby obviating the cost of brackets and the labor of drilling walls, etc. The result was a combination of transformer, box, primary fuses and service wire brackets, in one compact piece of apparatus, as shown in the accompanying cuts.

The Sterling Supply Company, 54 Second street, San Francisco, represents the Wagner Electric Manufacturing Company on the Pacific Coast.

THE LUNDELL EXHAUST FAN.

The design of the Lundell motor lends itself most readily in application to exhaust fan work. The motor, being iron clad, is almost wholly enclosed and easily permits of connection by radial arms, spider, or bolts to any of the many forms of exhaust fans now to be found in the market.

It has been the practice of manufacturers of exhaust fans to supply a bearing in front as well as in the back of the fan, but in the present application a shaft is carried which may be horizontal or vertical, in two bearings in the motor frame itself, not supporting the shaft in any sense from the fan ring. This course insures perfect alignment and noiseless running.

All Lundell exhaust fan outfits are made with horizontal shafts, unless otherwise ordered, and are invariably made so that the direction of the flow of air is from the motor toward the fan. If it is desired to operate the fan with a vertical shaft or to drive the air through the fan and over the motor, it should be specifically so stated in the order. With the standard horizontal shaft fans. an adjustable thrust bearing, as shown in cut, is provided. When the flow of air is desired contrary to the standard direction, a button and thrust bearing is placed at the rear of the motor. In the horizontal shaft fans, lubrication is effected in an oil receptacle enclosing a step at the bottom of the shaft, and a graphite or other self-lubricating bearing (never a grease-cup or oil bearing) at the upper end of the shaft.

The Lundell dynamos and motors are handled by Thos. Day & Co., San Francisco, the Pacific Coast agents for the Interior Conduit and Insulation Company.

TOO GOOD TO SUPPRESS.

The A. A. Griffin Iron Company, through its Western agents, Charles C. Moore & Co., is distributing a neat brouchure, pointing out the advantages to be derived from the use of Bundy return steam traps connected on boilers, by means of which, the necessity for running feed pumps is avoided. In the Bundy trap, the waters of condensation, by their own weight, furnish the valve operating power, for when the water in the pear-shaped bowl over-balances the weight of the ball, the bowl settles down into the frame, thereby opening the valve in the live steam connection from top of boiler or dome to trap, which equalizes the pressure on both trap and boiler, when the water, of its own weight, discharges into the boiler.

The conviction comes from reading the booklet, that the Bundy steam trap is too good a thing to suppress.

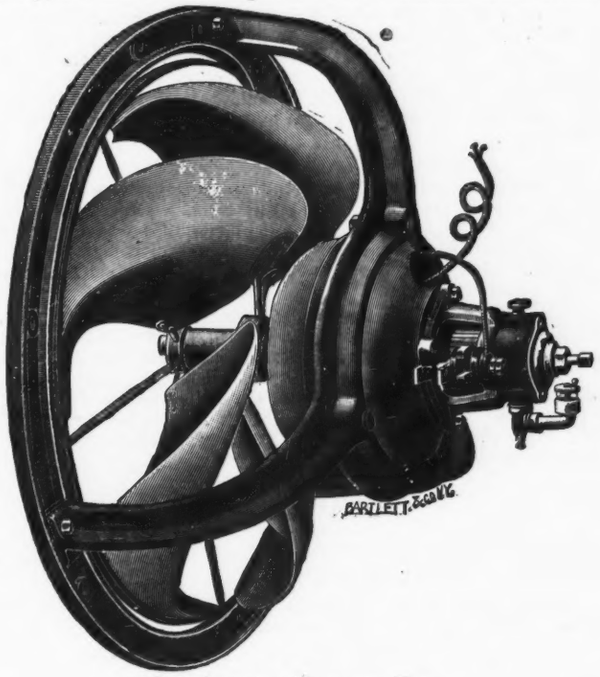
The Ferré Elastic Paint Company promises to make an interesting display of its new insulating paints and compounds during the Mechanic's Fair, soon to be held at San Francisco.

THE LAY PRESS.

POPULAR REFLECTIONS OF THE CONDITION AND PROSPECTS OF ELECTRICAL ENGINEERING ON THE PACIFIC COAST.

Plumas [County] has hundreds of ledges and plenty of ore easily extracted, at points where steam or water power for mining or milling purposes would be very expensive, possibly rendering the working of such ledges impracticable, but which are at such distance from streams capable of furnishing ample water power for large electric plants, that, by means of wires varying in length from one-half mile to five miles, electric power could be transmitted up out of canyons, over mountains and to any point desired. By means of such power, at once cheap and convenient, many of our low grade propositions, from $2 to $5 per ton, could be operated at a handsome profit. In fact, to work such mines successfully, cheap and reliable power is the great desideratum.

Just below Spanish Creek bridge, about five miles north of Quincy, is a most favorable point for the erection of an electric



THE LUNDELL EXHAUST FAN.

plant. Practically an unlimited amount of free water could be obtained, and, with a small expenditure, a pressure of from 70 to 100 feet easily secured. Within three miles of that point, are numerous quartz ledges carrying free gold. Some prospect as high as $8 to $10 per ton, but most of them from $2 to $5 per ton. If cheap and convenient power were supplied, all these properties would be developed and worked at a profit. Among the mines within range of such an electric plant may be mentioned the Bell, the Butterfly, the Kellogg, the Wormley, the Lee & Blakesley, the Orr, the Golden Gate, etc. Electric power from this plant would be of especial value in working the Elizabethtown channel claims from which, at points where operated, such quantities of large gold nuggets have been taken. This plant could also be utilized in furnishing electric lights to the town of Quincy—an item of no small interest.

The figures we have quoted and the facts mentioned as to location of plant and the mines within range of it, all point out a grand opportunity for capital seeking profitable investment. The venture, from the start, would be a paying one.—Quincy (Cal.) Bulletin, June 20th.

The whole State has cause to rejoice over the completion and transfer to it of the immense electrical plant at Folsom. The history of this great undertaking has been repeatedly published and is familiar to all. The State is now in possession of one of the greatest plants in the world for the generation of electricity, but of far greater value than that bare consideration is the fact that to the extent of its applicability it is a complete solution of the fuel problem, which always has been a drawback to the State.

The principle represented in the Folsom plant is the utilization of the power held by the perennial streams that flow down into the great valleys of the State from the Sierra Nevada. Thus the waters of the American River, which is only one of a vast number of these streams, are held by a dam and made to run electrical generators. At present the application of this enormous power is confined to Folsom, the Folsom prison and the city of Sacramento, but this is only a beginning, both of the use of electricity generated by this plant and of the utilization of the power held by the Sierra streams.

The advent of this power is particularly welcome just now when the natural disadvantages under which we labor on the score of expensive coal is aggravated by the formation of a combination for advancing its price. The Folsom plant is to be operated at a cost which represents but a fraction of the expense of coal required to generate an equal power. This matter has not yet been determined, but it soon will be, and we are confident that the revelation which it will make will be one of the strongest of conceivable incentives for pushing forward on new lines of enterprise and development that will produce a complete revolution in some of the most important concerns of our people.—San Francisco Call, July 13th.

The new era opening for Sacramento by the installation and successful working of the plant for the electric transmission of power from Folsom is one upon which the whole State can congratulate itself. If Sacramento can make use of the great power from a mountain river other cities can do the same thing. Every stream in California can be harnessed and a brilliant row of manufacturing cities will spring up along the whole length of the foothills of she Sierras.

Meanwhile Sacramento, as the pioneer in this part of the State, deserves the praise of all who are interested in the development of California. She has something now that is better than the Capitol, and something that no constitutional amendment can take away. The fuel question is solved, and with cheap power Sacramento ought to become a center of manufactures. It should be an i leal manufacturing place, too, with none of the smoke, grime and cinders of the coal-burning purgatories, but with fresh, clean, airy factories, in which the whirring electric motors will be attended by cheerful operatives, and where industry will not spoil the clear atmosphere for residence. We welcome the new Sacramento and wish it every success.—San Francisco Examiner, July 14th.

To communities that witnessed the successful introduction of the trolley system in the West years ago, and who have had long lines of city and suburban electric roads in practical operation so far back that a younger generation has come upon earth and the trolley system is regarded in the light of a back number, it is amusing to read in the columns of the Philadelphia papers articles descriptive of the "new system" and the wonderful revolution it is creating in supplanting the "horse cars," and bringing the suburban districts into town. Over a hundred years ago Franklin gave the Philadelphians the key to lightning, but they were slow to catch on, and the word became obsolete in that ancient place. Seattle could give those people some pointers on trolleys. A Western city that can burn up a trolley system at 1 a. m. and have it in active operation at 8 a. m., can teach Philadelphia some things in the way of modern progress that would convulse Benjamin in his grave, and make even the "horse cars" laugh.—Seattle (Wash.) Past-Intelligence, June 25th.

The figures given in yesterday's Argus, showing the amazing waste of money that has resulted from municipal ownership of the electric light plant, ought to interest every tax-payer. One of the reasons that taxes are high is because the city runs an electric plant. In eight years one hundred thousand dollars have been absolutely thrown away—absolutely, without question, for the lights could have been purchased of private parties for the excess beyond that amount. That excess would have been upwards of $8000 a year, and any private company would scramble for a contract to light Alameda for $8000 a year. Why cannot a common sense view be taken of the matter now? We have certainly had experience enough.—Alameda (Cal.) Argus, June 26th.

An electric railroad connecting the principal towns and cities of Southern California is a feasible project. Such a railroad would monopolize the passenger traffic because it could transport passengers as quickly and more cheaply than the steam roads. Between Redlands and the sea there is enough power going to waste to operate a thousand miles of railway. An electric railway from Redlands to Los Angeles is a project that is already enlisting the attention of capital, and its consummation is only a matter of time. Such a road would pay were it in operation now.—Ontario (Cal) Observer, June 10th.

It is worth noting that nearly all the predictions that electricians made ten years ago, have either been fulfilled, or are well on the way to such a result.—Oakland (Cal.) Tribune, June 29th.

On all sides Sacramento is now the recipient of congratulations as the pioneer city in this new scheme of low priced power and the utilization of water power to turn the wheels of industry through the agency of transmitted electrical energy. But we must keep in mind that these congratulations will be repeated for other cities and towns which secure similar advantages by similar means. Thus, within three months electrical power transmitted thirty-five miles will be introduced into Fresno, and that place will then boast of the longest distance of transmission in the world. * * * Interests are becoming fixed just now that have long been fluctuating. Next year and the next are to determine what are to be the large and prosperous centers in this State, and those cities and towns that are not to the forefront within that period will be likely to remain far in the rear for many years.—Sacramento (Cal.) Record-Union, July 15th.

The rapid development of electrical engineering bids fair to greatly aid California. Hitherto the water power of the State has been little used owing to the fact that in most localities where it exists it is practically unavailable by the old methods, which required its utilization on the spot, or by which its distant employment was made extremely costly. In some instances water was carried several miles in pipes or ditches, for the purpose of operating water wheels, but this manner of utilization restricted its employment within comparatively narrow limits, and could only be adopted where the power was applied at an altitude lower than that of the source of the water. * * * Now, however, the electrical works at Folsom, on the American River, are partially in operation, and are supplying a thousand horse-power. * * * Like utilization of water power for long-distance transmission of electricity will eventually be made on the Upper Sacramento, the Feather, Yuba, Bear, Mokelumne, Russian and other rivers. It is well within the limits of possibility that electric power shall some day be brought to this city from the streams of the Sierra or the Coast Range, and it would seem that with such an unlimited power at command, and at trifling cost, the development of manufacturing in the district thus favored should go forward rapidly.—San Francisco News-Letter, June 6th.

News of the Month.

LITIGATION.

BALLARD, WASH.—The Mayor has received a summons from George F. Gund in a suit for $6200 against the city for breach of contract in the purchase of an electric light system.

TACOMA, WASH.—Efforts are being made to compromise the $1,000,000 suit brought against the Tacoma Light and Water Company by the city to recover the money paid the company for the plant now held by the city.

SEATTLE, WASH —Federal Judge Hanford has set aside a verdict which Howard Baker secured against the Western Union Telegraph Company for $6000 because of an error made in a cablegram in making h s name appear "Barker," on the ground that the damages awarded are excessive. The matter will now undoubtedly be compromised.

LOS ANGELES, CAL.—Western Union Telegraph Company has filed a complaint in equity against the Los Angeles Lighting Company for an injunction to restrain the defendant from putting up a line of poles and erecting electric wires thereon in line with the pole lines of the plaintiff on Second and Alameda streets. The telegraph company avers that induction would so distort the signals on the duplex and quadruplex instruments as to render their signals liable to serious interference.

COMMUNICATION.

OAKLAND, CAL.—The City Council has advertised for bids for a telegraph and telephone franchise.

JACKSONVILLE, OR.—The new telephone line between here and Crescent City, Cal., has been completed.

PORTLAND, OR.—The Columbia Telephone Company is busily erecting poles for its new system in this city.

SAN FRANCISCO.—The Pacific Telephone and Telegraph Company is placing its wires underground in the Mission.

PRESCOTT, ARIZ —Work is being prosecuted on a telephone line to Chaparrel via Lynx Creek Camp. Lines are also to be built to Jerome and all important mining camps in the country.

SAN FRANCISCO.—The Sunset Telephone and Telegraph Company has purchased 100 cells of chloride battery for operating "Express" systems of telephone exchanges in various cities of the Coast.

SAN JOSE, CAL.—The Council has adopted a resolution that it is the intention to grant a franchise authorizing the construction of a telephone and telegraph system, and inviting proposals for the same.

SPOKANE, WASH.—The Spokane Terminal Railway has been incorporated, and under its articles it has authority to maintain telegraph and telephone lines or contract with telephone companies for the construction and maintenance of such lines.

SALT LAKE CITY, UTAH.—The Rocky Mountain Bell Telephone Company and the Salt Lake and Ogden Gas and Electric Light Company have consummated an agreement by which both companies will utilize the same poles whenever possible.

SAN JOSE, CAL.—The California Telephone and Construction Company, by its Secretary, Walter M. Field, has applied for a telephone franchise. The petition states that the Columbia Telephone and the Smith system are to be used and the company has 400 subscribers.

HELENA, MONT —The Rocky Mountain Bell Telephone Company has practically completed its long distance line between this city and Great Falls, a distance of about 100 miles. New lines have also been erected between Helena and Butte, and between Butte and Basin.

WALLA WALLA, WASH.—The offices of the train dispatchers on the Washington division of the O. R. & N. Company have been moved from Walla Walla to Starbuck. At present, under W. E. Borden as chief, the office handles all trains between Pendleton and Umatilla and Spokane, and branches from Walla Walla, and also transact all the telegraph business pertaining to the Starbuck shops.

SACRAMENTO, CAL.—The Capital Telephone and Telegraph Company has practically completed the poling and wiring of this city for its new exchange, which will have a capacity of about 1,000 subscribers. Metallic circuits of No. 12 bare copper wire are used throughout, and the Columbia transmitter has been adopted. V. J. Mayo is electrician and E. Severance is manager of the Company.

SAN FRANCISCO, CAL.—Walter Francis Burns of the Standard Telephone Company of New York, states that his company has obtained the exclusive franchise for the placing of a system of long distance telephones in Japan. The first operations will be in the cities of Tokio and Yokohama, after which lines will be extended all over the empire. Mr. Burns sailed for Japan on July 23d, and was preceded by a number of men to be employed in the construction of the system.

ILLUMINATION.

CHICO, CAL.—H. H. Clark, of Santa Cruz, has been granted a franchise for an electric light plant.

LOS ANGELES, CAL.—E. E. Peck has been granted a franchise for an electric lighting, power and heating plant.

OROVILLE, CAL.—Max Marks has been granted an electric light and power franchise in this city and vicinity.

SAN FRANCISCO.—The Mutual Electric Light Company is laying redwood conduits throughout the business section of the city.

WATERLOO, OR.—An incandescent plant is to be placed in the woolen mills. Capacity, 300 lights.

BERKELEY, CAL.—The local electric light company has installed a new 200 h. p. Corliss engine.

PASADENA, CAL.—The Electric Light and Power Company has moved its offices to the Banning Block.

NAPA, CAL.—A 70-light incandescent plant is being installed by C. W. Fox in the woolen mill in East Napa.

PHŒNIX, ARIZ.—The Electric Light Company has ordered an additional 1,000-light General Electric generator.

HAMILTON, MONT.—It is expected that the new electric light plant will be completed during the present month.

WALLACE, IDAHO.—General M. C Moore has purchased an Edison 110-light dynamo to be used for an isolated plant.

SALT LAKE CITY, UTAH.—The Citizens' Electric Light Company are erecting their pole lines throughout the city.

NAPA, CAL.—L. Grothwell has been awarded a franchise for electric lighting privileges from the Asylum to Calistoga.

OLYMPIA, WASH.—The new State Capitol building will be equipped with an electric lighting plant and an electric elevator.

SALT LAKE, UTAH.—The Salt Lake Irrigation, Light and Power Company has been incorporated with W. P. Noble, President.

OROVILLE, CAL.—A 60-kilowatt Westinghouse alternator has been ordered by the Oroville Gas, Electric Light and Power Company.

SOUTH BEND, WASH.—Arrangements have been concluded by which C. S. D. Sale will continue to operate the electric light plant.

ALVARADO, CAL.—A 20-kilowatt Siemens-Halske incandescent lighting dynamo and plant has been ordered for the Alvarado Sugar Refinery.

EUGENE, OR.—The Board of Regents of the State University has concluded to light the University buildings and dormitory with gasoline gas.

WEAVERVILLE, CAL.—The Weaverville Electric Light Company has ordered two new dynamos, which will double the capacity of the plant.

REDLANDS, CAL.—The Light and Power Company is soon to extend its pole line from this city to the Asylum, a distance of about seven miles.

ORANGE, CAL.—The Santa Ana Gas an l Electric Light Company has asked for an exclusive franchise over all streets for electric lighting purposes.

REDLANDS, CAL.—The Redlands Light and Power Company has secured the contract for the electric lighting in the Highlands Asylum at $375 per month.

SAN LEANDRO, CAL.—The matter of installing a municipal electric lighting plant has been referred to Trustees Eber, Cary and Downie for consideration.

SPOKANE, WASH.—The Consumers' Light and Power Company, by Simon Oppenheimer, President, has received an electric lighting and power franchise.

QUINCY, CAL.—Dr. R. Heidrich and F. Gausner, of San Jose, are conferring with Judge Goodwin regarding the advisability of putting in an electric light and power plant.

FERNDALE, CAL.—An electric light plant is desired here, and Oluff Andreason has made a liberal offer to operate the same. The plant complete would cost less than $5,000.

ANTIOCH, CAL.—The Ledger states that C. M. Belshaw is seriously considering the proposition of putting in an electric light plant in connection with the water works.

SOUTH SAN FRANCISCO.—Miller & Lux have ordered a 150-light 110-volt chloride battery to supplement the incandescent lighting plant of their cold storage warehouses.

SAN FRANCISCO.—The local papers announce that the electric light and power plant proposed to be placed by the San Francisco Gas Light Company, will be driven by gas engines.

JACKSON, CAL.—B. E. Letang, of the Jackson Gas Works, has fully decided to put up an electric light plant this Fall and have it in running order by the beginning of winter.

ALAMEDA, CAL.—The city has accepted the arc and incandescent dynamos purchased from the Westinghouse Electric & Manufacturing Company, and has cancelled the bonds given.

LOS ANGELES, CAL.—W. L. Richardson has applied for an electric light and power franchise, and the Board of Supervisors has advertised for bids for same to be received until August 7th.

SAN FRANCISCO.—E. C. Jones, engineer for the San Francisco Gas Light Company, read a paper illustrated by practical experiments, on "Calcium Carbide," before the last meeting of the Academy of Sciences.

PHŒNIX, ARIZ.—The Phœnix Electric Light and Fuel Company has received and is erecting a 1,500-light monocyclic generator and two new boilers, having a capacity of 250 h. p. to supplement its present plant.

SALT LAKE CITY, UTAH.—All machinery for the power house and the supplies necessary for the construction of the new plant of the Citizens' Electric Light Company, have been shipped from the East.

SAN FRANCISCO, CAL.—The new Cliff House, now being erected on the site of the old Cliff House, is being wired with the conduit system, using the flexible tubing of the American Circular Loom Company.

SAN FRANCISCO.—Fifty-eight 1,000-ampere-hour chloride accumulator cells are to be placed in the Safe Deposit building. Regulation will be effected by the "booster" system of the Electric Storage Battery Company.

SAN JOSE, CAL.—The San Jose Light and Power Company, at the annual meeting of stockholders on June 21st, elected C. W. Quilty, President; Uriah Wood, Vice-President; W.W. Gillespie, Secretary; and C. T. Ryland, Treasurer.

SAN FRANCISCO.—Bids have been received for the electric wiring of the Parrott building for 4,000 incandescent and 400 arc lamps. The lowest bid received was that of E. H. Forst for $32,-964, and to whom the contract was awarded.

SAN RAFAEL, CAL.—The Electrical Construction and Repair Company, of San Francisco, has built the pole line from this city to Mill Valley, and will connect up all Mill Valley circuits thereto for the San Rafael Gas and Electric Light Company.

LOGAN, UTAH —The Hercules Power Company has completed its dam across the Logan River in Logan Canyon, and it is said will soon purchase turbines and electrical machinery for transmitting light and power to this city and surrounding towns.

VENTURA, CAL.—The people of Ventura have voted for the issuance of $130,000 bonds, of which $106,500 is for the purchase of the Santa Ana Water Works and $23,500 is for the purchase of the arc light system of the Ventura Land and Power Company.

SEATTLE, WASH.—The Third Street and Suburban Company has erected a power house adjoining that of the Seattle Steam, Heat and Power Company, on West street, in which are placed the dynamos for operating the lighting circuits of the Company.

TACOMA, WASH.—Mayor Orr has vetoed the ordinance proposing to reduce the price of gas as soid by the Tacoma Gas and Electric Company, on the ground that the present rates of $2 a thousand for lighting purposes and $1.75 for heating purposes are reasonable.

SANTA CRUZ, CAL.—The Santa Cruz Electric Light and Power Company is driving a 1,000-light alternator by means of an Otto gas engine. The plant is operating satisfactorily, and two more similar double cylinder gas engines will probably soon be placed, displacing the use of steam.

SAN FRANCISCO, CAL.—The Park Commissioners, in response to many imperative demands, are considering ways and means for lighting the park drives. It is probable that material assistance towards defraying the cost will be received from bicycling clubs and livery stable people.

SPOKANE, WASH.—The County Commissioners have abandoned the idea of erecting an isolated electric lighting plant in the new Court House, the reason assigned being that the current can be bought from central stations more cheaply than it can be produced in an isolated plant.

PRESCOTT, ARIZ.—The Prescott Electric Light Company has been incorporated with a capital stock of $100,000. President and Treasurer, Frank L. Wright; General Manager, J. D. Moore; Secretary, F. A. Cole; who, with R. H. Burmister and William E. Hazeltine, constitute the Board of Directors.

SAN JOSE, CAL.—The Electric Improvement Company has concluded to meet the competition of the San Jose Light and Power Company at all points, and is therefore engaged in laying mains preparatory to the erection of a gas plant. It is probable that a hard gas war will follow the electric light war that has waged so long between these companies.

LEADVILLE, COL.—Some of the stockholders of the Denver Consolidated Electric Company, among whom are E. W. Rollins, Jonn Poole and Colonel Goddell, have organized a light and power company here. The plant will be operated by water power, or will use some multi-phase system. C. E. Doolittle has been engaged to superintend the designing and construction of the plant.

OAKLAND, CAL.—The stockholders of the Oakland Gas, Light and Heat Company, at their annual meeting held on August 5th, unanimously re-elected the old Board of Directors, consisting of Joseph P. Eastland, John W. Coleman, D E. Martin, John T. Wright and James Moffitt. Mr. Eastland was elected President, Mr. Coleman Vice-President, and John A. Britton Secretary and Treasurer.

PHŒNIX, ARIZ.—The Phœnix Light and Fuel Company and the East End Electric Light Company, known as the Gardiner plant, have effected a combination to go into effect on August 18th. The Gardiner plant will be removed to the works of the other Company on First avenue and an advance in rates will undoubtedly result, as competition has been such that the Companies have heretofore been operating at a loss.

SAN FRANCISCO, CAL.—The Edison Light and Power Company, at its fourth annual meeting, held July 15th, elected J. B. Stetson, W. F. Whittier, W. E. Brown, Gustav Sutro, L. P. Drexler, C. E. Green and John J. Valentine as Directors, after which the Directors elected the following officers: President, J. B. Stetson: Vice-President, W. Brown; J. E. Green, Secretary and Manager; William Angus, Assistant Secretary; R. J. Davis, Assistant Manager.

TRANSPORTATION.

SARATOGA, WYO.—An electric railway is projected between this place and Walcott, a distance of twenty-two miles.

SALEM, OR.—The Davidson Park branch line of the Salem Motor Company has been completed and is in operation.

WHITTIER, CAL.—The sum of $7050 has been subscribed towards building an electric railway in this place and vicinity.

SEATTLE, WASH.—David Bruce has been appointed Superintendent of the Union Trunk lines vice E. B. Hussey, resigned.

ANTIOCH, CAL.—C. M. Belshaw is considering the advisability of constructing an electric railway here.

PHŒNIX, ARIZ.—The Phœnix Electric Railway Company has purchased an additional 25 h. p. Westinghouse railway equipment.

SAN PEDRO, CAL.—A ship-load of cedar poles for the Los Angeles and Santa Monica Electric Road has arrived from Everett, Wash.

SEATTLE, WASH.—Fifteen "G. E. 800" railway equipments have been ordered by the Seattle Consolidated Street Railway Company.

GALT, CAL.—The work of grading for the electric road between Stockton and Lodi is progressing rapidly, and the road will be completed within twelve weeks.

SEATTLE, WASH.—Sixty-seven miles of street-car lines, both electric and cable, are used by the Postoffice Department in this city for the transportation of mail.

SAN DIEGO, CAL.—It is reported that George Kerper, owner of the property of the cable road, proposes to start up the line after having equipped it with the trolley.

SEATTLE, WASH.—The Seattle Consolidated Street Railway Company has decided to build a fire-proof station and car barn on the site of the station recently burned.

SEATTLE, WASH.—F. L. Dame has resigned the general managership of the Consolidated Street Railway Company and S. L. Shuffleton has been appointed his successor.

SAN FRANCISCO.—Orders have been issued to conductors of the Market-street Railway Company's system to issue transfers to parallel lines of the Company in case of stoppage.

SAN FRANCISCO, CAL.—The trolley will soon supplant the cable on the Ellis street line of the Market-street Railway Company, and the cable road on Oak street will be the next to go.

HERMOSILLO, MEXICO.—It is believed that the Government of Mexico has granted H. T. Richards a concession to build a street railway here, to be operated by horses or electricity.

SAN FRANCISCO, CAL.—Four bids have been received for the power plant for the Sutro-street Railway, and it is said that the road will be in operation to the Sutro Baths by October 1st.

TACOMA, WASH.—The power house for the Fern Hill and Puyallup branch of the Tacoma Traction Company is completed and is now operating all cars on the Edison and Puyallup lines.

LOS ANGELES, CAL.—The Los Angeles Railway Company, owning forty-seven miles of street railroad, proposes to reorganize its system, and will undoubtedly change its cable lines to electric.

GALT, CAL.—The Gazette is of the opinion that the people of Galt should reach out and offer some inducement for the introduction of the electric power and electric transportation for their town.

SAN FRANCISCO, CAL.—The Market-street Railway Company has obtained a franchise for the construction of an electric line through Sunnyside, Corbett and Ocean avenues to the new racetrack.

SAN FRANCISCO, CAL.—The Market-street Railway Company is to equip the horse car line at present running on Tenth street and Potrero avenue to the Potrero and South San Francisco with the trolley.

TACOMA, WASH,—The City Park Railway Company will build a 2000-foot extension into Point Defiance Park at once, as all papers with the Park Commissioners have been signed and the contracts awarded.

SEATTLE, WASH.—Two cars on the West Street and North End Electric Railway, running between this city and Ballard, have been running as scheduled for months with a daily mileage of 225 mileage each.

BOISE CITY, IDAHO.—The Boise Rapid Transit Company enjoys the distinction of being an electric railway company that is able to run a power house and operate a single car, and yet make satisfactory dividends.

OAKLAND, CAL.—The Oakland Consolidated Street Railway Company has contracted with the Walker Electric Manufacturing Company for the purchase of a 400-kilowatt Walker railway generator, to be driven by rope transmission.

ST. HELENA, CAL.—A franchise for the construction of an electric railway along Main street, and for the erection and operation of telephone, telegraph and electric light lines will be sold on August 13th.

SHANGHAI, CHINA.—L. S. J. Hunt, formerly owner of the Post-Intelligencer of Seattle, has secured from the Shanghai Council the right to construct an electric street car system at a cost of $2,000,000 in gold.

SACRAMENTO, CAL.—L. T. Hatfield has been awarded a franchise to construct and operate an electric railway on V street, which is believed to be for the recently organized Sacramento, Fairoaks and Orangevale Electric Railway Company.

PORTLAND, OR.—The Vancouver cars are running through from the intersection of Second and Washington streets, Portland, to the Vancouver ferry landing on the Columbia River, enabling passengers to make the entire trip for one fare.

SAN FRANCISCO.—C. M. Bridges is exhibiting a model of an underground conduit electric railway system in the History Building, in which the working equivalent of the trolley wire is on the car, while the equivalent of the trolley is in the conduit.

SAN FRANCISCO, CAL.—The Sutter-street Railroad Company has decided to extend its Pacific avenue line by building an electric road out Pacific avenue from the terminus of the cable line at Devisadero street to Walnut street through Richmond to the Park.

LOS ANGELES, CAL.—Notice of sale of franchise has been published for an electric railway to run from the intersection of Freeman street with Bush street, thence southwesterly on Bush street to Hoover, thence south on Hoover street to Forrester avenue. Bids must be in by August 19th.

OAKLAND, CAL.—The Southern Pacific Company is waging a hot fight against the Oakland, San Leandro and Haywards Electric Railway Company since the latter has established an express service for the carrying of parcels, etc., between San Francisco, Haywards and the way towns along the line.

SACRAMENTO, CAL.—The Sacramento, Fairoaks and Orangevale Electric Railway has been organized to build a line, preferably along the north bank of the American River from Orangevale and Folsom to this city. The road will undoubtedly be operated by power from the plant of the Electric Power and Light Company.

SANTA BARBARA, CAL.—The Santa Barbara Consolidated Electric Company, proposing to construct, acquire, operate and maintain electric railways in the county of Santa Barbara, has been incorporated with a capital stock of $200,000, of which $40,000 is subscribed. Its President is S. J. Keese, a well-known electrical engineer of Los Angeles.

SAN FRANCISCO, CAL.—The Market-street Railway Company has commenced work on its new electric power house to be erected on the corner of Bryant and Alameda streets. When finished, it will be the largest electric plant in the country, and will be used to drive all the electric street-car lines belonging to the Market-street system. The power-house of the Metropolitan Railroad will then be abandoned.

IRON MOUNTAIN, CAL.—The Iron Mountain Railway Company, of Shasta County, has been incorporated with Alfred Fellows and Charles W. Fielding, of England, and L. B. Parrott, C. O. Eels and M. M. O'Shaugnessy as Directors. The Company proposes to build a steam or electric railroad from the Iron Mountain Mine to the Spring Creek crossing, on the California and Oregon Railroad, a distance of 12½ miles, thence to Popley Station.

TACOMA, WASH.—A bill of sale has been filed conveying the property of the Point Defiance-street Railway Company to the City Park Railway Company for $163,000. Shortly after the sale the City Park Railway Company filed a mortgage on the property for $163,000 to S. Z. Mitchell at six per cent. per annum, one note being for $13,000, and thirty for $5,000 each, all of them payable on demand at the office of the Old Colony Trust Company, of Boston.

LOS ANGELES, CAL.—The new electric system of the Los Angeles Traction Company will be in operation by September 1st. The road is being constructed in a substantial manner with sixty-pound rails, the overhead wiring, etc., is completed, and the entire equipment will be modern. The road is to run from the Santa Fe depot to Hoover street, the line of construction being as follows: From the depot up Third to Hill, to Eighth, to Pearl, to Eleventh, to Bush, to Hoover.

SAN FRANCISCO, CAL.—Contracts for equipments for the Sutro Electric Railroad have been awarded as follows: To the Westinghouse Electric and Manufacturing Company, 6, type 12A 25 h. p. equipments; to the Walker Manufacturing Company, fifteen 25 h. p. equipments; to the General Electric Company six "G. E. 800" equipments, also one 400-kilowatt, and one 200-kilowatt railway generators, to be direct connected to Fulton Iron Works engines.

LOS ANGELES, CAL.---Most of the material for the extension of the Pasadena and Pacific Electric Railway, from this city to Santa Monica, is on the ground, and the work of construction will begin about September 1st, or as soon as the right-of-way and franchise matters can be settled. The extension will be eighteen miles long and double-tracked throughout. Two dynamos for the Santa Monica division are here. They have a capacity of 350 and 450 h. p. respectively. Oil is to be used as fuel.

LOS ANGELES, CAL.—Articles of incorporation have been filed by the Commonwealth Trust Company of Los Angeles county, formed for the purpose of obtaining rights of way, subscriptions, donations, etc., for the construction of a railway from Victor to Hesperia, San Bernardino county, through Antelope Valley and Tejon Pass, Kern county, to Bakersfield, to be operated by steam or electricity. The directors are T. W. Haskins, C. M. Wells, Nathan Cole, Jr., E. S. Mead, A. C. Sprague, C. A. Richey and S. C. Wilcox.

AUBURN, CAL.—Messrs. Hartley & Reynolds, well-known mining men, have applied for an electric street railway franchise to be built on the main thoroughfare from the station to lower Auburn. The projectors intend to have the road in operation by next winter, and whenever business will justify, will extend the line. Power will probably be purchased from the Ball Electric Light Company, and the accepted franchise calls for the completion of the road within one year.

SAN FRANCISCO, CAL.—The Presidio and Ferries Railway Company, operating a horse car line from the ferries to the intersection of Montgomery avenue and Montgomery street, and a cable road thence via Montgomery avenue and Union street to the Presidio, is to reconstruct its road-bed, and equip the line as an electric railway. This is one of the most hilly railways in the city, encountering grades as high as 18½ per cent., but excessive grades will be equipped with auxiliary cables.

SAN FRANCISCO, CAL.—The Washburn Moen Manufacturing Company has acquired the business and plant of the California Wire Works, will hereafter operate the same in conjunction with their factories at Worcester, Mass., and Waukegan, Ill. With the fine rope and cable machinery and trained mechanics of the California Wire Works they claim to be prepared to manufacture and promptly supply the strongest and most serviceable wire rope and cables made in the world.

SEATTLE, WASH.—The franchise of the Consolidated Street Railway Company has been renewed, with several modifications, principal among which are that from the years 1900 to 1909 inclnsive, the company is to pay the city 1 per cent. of the gross receipts, and from 1910 to 1944 inclusive, the company is to pay 2 per cent. The new franchise requires also that when the city shall have a population of 125,000, the company shall be required to issue transfers to cross lines, and to accept tickets from such cross lines.

HAYWARDS, CAL.—E. P. Vandercook has been granted a franchise for an electric road from Oakland to Livermore. The proposed road is to start from Lynde street and Peralta avenue, Oakland, and will strike San Leandro; thence along the county road from San Leandro by the way of Lake Chabot to Castro Valley, following said road to its intersection with the road from Haywards to Moraga Valley; thence along said road to the Haywards and Dublin road to the town of Dublin, and from there to the town of Livermore.

SAN FRANCISCO, CAL.—The State Railroad Commission, acting under a decision of the Attorney General to the effect that all roads, whether steam or electric, carrying freight must report to the Railroad Commission, has ordered the San Francisco and San Mateo Electric Railway Company to report to it, because the road owns and operates a funeral car, and carries bodies to the Holy Cross Cemetery for interment. The road has refused to report as ordered, and the lawyers are trying to decide whether a hauling dead body is freight or passenger traffic.

SAN FRANCISCO.—The first two units of the eight 400-kilowatt Siemens-Halske generators for the Market-street Railway Company will be in operation by the middle of August. When completed the plant will consist of four vertical triple expansion Union Iron Works engines, running at 145 revolutions per minute at an initial pressure of 175 pounds of steam, each engine being direct connected to two 400-kilowatt dynamos. The Union Iron Works is installing 5,000 horse-power of water tube boilers of its own manufacture in the Bryant-street power house.

TACOMA, WASH.—Postmaster Case has rendered a report to the Postoffice Department in regard to mail service on electric roads in this city. The report shows that the following lines are used: Tacoma Railway and Motor Company, city lines-34.80 miles, carrier service to Steilacoom, 13.25 miles, mail contract; Tacoma Traction Company, to Midland, 9.38 miles, mail contract; Tacoma Traction Company, to Edison Junction, 5 miles, carrier service; City Park Railway, to Smelter, 7.60 miles, carrier service. The total number of miles used daily by the postal service is therefore 70.3 miles.

SAN FRANCISCO, CAL.—The West Shore Railroad Company has been incorporated for the purpose of constructing and operating a double or single track railroad by steam, electricity or other motive power, through San Mateo and Santa Cruz counties from San Francisco to Santa Cruz. The estimated length of the road is eighty miles, and the capital stock is $2,000,000, of which $88,000 has been subscribed. The Directors are C. M. Sanger, of San Leandro, Behrend Joos', of San Francisco, Robert S. Thornton, of Colma, John W. Eisenhuth, of San Francisco, and Louis Dunand, of San Rafael.

TRANSMISSION.

SALINAS, CAL.—A. L. Burbank has secured the right of way for water mains from the Arroyo Seco, the object being to secure water for King City and for the installation of an electric transmission p'ant.

BERUS BAY, JUNEAU, ALASKA.—The Berus Bay Mining and Milling Company has recently installed a 25-kilowat Edison Generator operating two 15 horse-power Edison double reduction railway motors used for hoisting.

CŒUR D'ALENE, IDAHO.—The Poorman, Tiger, Gem and Frisco Mines, which are the wealthiest mines in the State, are working up a plan to utilize the power of Thompson Falls for the operation of the mines in the Cœur d'Alene district.

BAKERSFIELD, CAL.—It is intended to run the Big Blue, the Joe Walker, Bright Star, the Keysville and any other mining property within a radius of fifty miles from the Kern County power plant by electricity, both for pumping and mining.

REDDING, CAL.—The English syndicate which recently purchased the Iron Mountain Mine is engaged in considerable development work, and will probably erect a reduction mill near Copley to be run by electric power transmitted from a neighboring spring.

YELLOW JACKET, IDAHO.—The water power of Yellow Jacket Creek is to be used to drive the mine and mill at this place. The transmission will be one mile, and experts have reported that these improvements will be necessary before the mine can start up with satisfactory results.

BODIE, CAL.—The Standard Consolidated Mining Company, which was the first to install a long distance electric transmission plant on the Pacific Coast, has increased its plant by the addition of a 100 h. p. General Electric generator for operating pumps, hoisting machinery, etc.

SEATTLE, WASH.—F. H. Osgood and E. H. Ammidown have announced that they are prepared to enter into a contract to deliver to the city any amount of water necessary from the Cedar River falls. This will deliver water into the city at high head, the utilization of which, for electric purposes, is being considered.

OROVILLE, CAL.—It is believed that the Golden Feather Mine, comprising about a mile of the Feather River bed, will be practically worked out this year, in view of which its owners are considering the advisability of utilizing the water power at the command of the mine for electric transmission purposes. Probably 5,000 horse-power can be developed.

LOS ANGELES, CAL.—The Journal states that a survey is being made at Tejunga for the development of water on a large scale by means of tunnels and percolating pipe, by people whose identity is kept secret. Already nearly $2000 has been expended on preliminary work, and the Los Angeles Railway Company has agreed to abandon its present steam plant and adopt power from the electric transmission, provided a saving of 5 per cent. will be effected thereby.

LOS ANGELES, CAL.—H. Hawgood, Consulting Engineer of the Kern River and Los Angeles Electric Power Company, has sent out a party, under F. H. Olmstead, to locate a route for the transmission line from the point where power is to be generated to this city, a distance of about 105 miles. The work of the surveying party will occupy about a month, and in the meantime work on the canal is progressing rapidly. From the report of W. D. Larrabee, C. E., it appears that 10,000 horse-power at 200 feet fall, or 50,000 horse-power at 1,000 feet fall, can readily be developed. It is expected to develop and tronsmit to Los Angeles 40,000 horse-power, which can be done at a cost of $125 per horse-power.

SALT LAKE CITY, UTAH.—Contracts have been closed in New York for the complete transmission plant of the Big Cottonwood Power Company. Four General Electric 400-kilowatt tri-phase generators are to be driven from Pelton water wheels, each generator being direct coupled to a Pelton wheel. The plant will be an innovation in that the wheel house will be moulded to and occupy the position on the dynamo base ordinarily held by the dynamo pulley, which at once makes a very compact installation. The Pelton wheels will be about four feet in diameter and will be driven at a head of 380 feet, water for the same being carried

partly in wood-stave pipe and partly in iron pipe. The total transmission will be for seventeen miles, at 10,000 volts, and the entire equipment has been ordered. The Big Cottonwood plant was conceived and promoted by R. M. Jones, the well-known hydraulic and electric engineer of this city.

TULARE, CAL.—All rights of way for the Keweah Electric Power Company have been secured.

GRASS VALLEY, CAL.—Eugene J. de Sabla has been appointed Superintendent of construction of the Nevada County Electric Power Company, with headquartes in this city.

REDLANDS, CAL.—President Baldwin of Pomona College has a force of men at work on his tunnel in Mill Creek, which is designed to develop power for an electric plant. The tunnel is now 300 feet deep.

GRASS VALLEY, CAL.—The Gold Hill Mine will commence operations again as soon as electric power can be obtained from the Nevada County Electric Power Company, now under construction. The mine has long been idle because of the high price of fuel.

FERNDALE, CAL.—Surveyors Shaw and Francis have reported adversely upon a proposition to utilize the water power of the Upper Bear River for transmission to this place, as the cost would be tyo great.

JACKSONVILLE, OR.—The Klamath Falls Light and Water Company, recently incorporated for the purpose of erecting and operating an electric plant and water works, has purchased a site from E. R. Reames, and have contracted with the irrigation company to run their plant.

SAN FRANCISCO.—The American Power and Tide Wheel Company has been incorporated for the purpose of securing and owning water rights; to construct and own reservoirs and canals; to erect, sell, own and use prime movers and power plants to be run by electricity, water, steam or other means. Directors, Chas. Boone, Marcus S. Love, A. H. St Marie, R. M. Clements, of this city, and D. E. Alexander, of Sacramento. Capital stock, $900,000.

MISSOULA, MONT.—The Board of Trade has adopted resolutions favorable to a proposition submitted by the Missoula General Electric Company for the damming of the Missoula River. Under this proposition the citizens of Missoula are to guarantee title and flowage rights to either the Heyfrow or Kroone ranch, with flowage rights, and to subscribe $15,000 to the first mortgage bonds of the Electric Company, which amount to $15,000. The city is to extend the light contract with the Company for a minimum of 31 lights, five years beyond the present contract period. If these conditions be fulfilled the Company agrees to build an 18-foot dam and power house by January 1st. The Company states that 500 horse-power will be developed for electric purposes. The dam will develop 3,000 horse-power at low water, of which 600 horse-power will be used for irrigating. $11,000 is already subscribed and the plan meets with general approval.

BAKERSFIELD, CAL.—Specifications asking for bids have been issued by the Power Development Company, of San Francisco. The Company proposes to develop the water power existing at the mouth of the Kern river canyon, about fourteen miles northeast of Bakersfield, which will be used under a head of 190 feet, and furnish at least 10,000 horse-power. Some of the best capitalists in San Francisco control the Company and it is proposed to supply power to consumers at a price equivalent to what it would be if coal could be bought for $6 per ton. The present price of coal in Bakersfield is $13 per ton. The flume line is nearly completed, and on August 15th the contract will be let for the remainder of the construction work. A seventy-two inch steel pipe will be used to convey the water from the end of the long flume to the water-wheels in the power house. At first 1500 horse-power will be developed, and this will be gradually increaled from time to time to meet the demands for extra power. There are some valuable mines about thirty miles east of Bakersfield, that require about 1300 horse-power, and they will be accommodatod next summer.

SAN FRANCISCO.—Satisfactory progress is being made by the Clear Lake Electric Company toward the utilization of the waste water power of Clear Lake, in Lake County, for delivering electric energy to San Francisco, Oakland, Benecia, Mare Island, Vallejo, Santa Rosa and other cities along the line. The investment necessary to develop the power may reach $3,000,000. Clear Lake has a surface area of eighty-two square miles and a catchment area of 517 square miles. Its average depth is forty feet and the average rainfall, as taken from different measurements and observations from 1867 to date, is 34.4 inches per annum, 50 per cent. of which for utilization would amount to 119,565 000.000 gallons per annum, or 327,000,000 gallons daily. By building a 27-foot dam across Cache Creek, the outlet of the lake at a point five miles below the lake, and by building 67,300 feet of 5-foot pipe line, a head of 424 feet of water will be obtained which will develop 28,950 horse power at the dynomos. Clear Lake lies at an elevation of 1317 feet, a distance of seventy-five miles due north of San Francisco, and the company hope to be able to sell power in San Francisco for $4.00 per horse power per month. The construction of an electric railway, to be known as the Clear Lake and Vaca Valley Railroad, from Clear Lake to Benecia is also contemplated.

MISCELLANEOUS.

SAN FRANCISCO.—Union No. 6 of the National Brotherhood of Electrical Workers held their annual picnic at Schuetzen Park on July 14th.

SANTA BARBARA, CAL.—San Francisco parties have leased all the bituminous rights of the Alcatraz Asphalt Company, at Carpenteria and will sink oil wells.

PALOUSE, WASH.—The Palouse Mica Company has been incorporated by Charles Treavor Cross, John P. Duke and William Goodyear. Capital stock, $100,000.

SAN DIEGO, CAL.—Mayor Carlson has vetoed an ordinance imposing a ground rental of fifty cents per annum for each pole erected or used for electrical purposes.

SAN FRANCISCO.—The illustrations which appeared in the Morning Call concerning the recent fiesta in Los Angeles, were transmitted from that city by the telautograph.

BAKERSFIELD, CAL.—It is reported that Captain John Barker recently signed a contract with parties in San Francisco to bore for gas and oil at his place on Kern river, about six miles above here.

ANACONDA, MONT.—E. M. Talbot, foreman of the power house of the Anaconda Electric Light and Power Company, was instantly killed on July 7th by the bursting of a pulley on the main shaft.

WATSONVILLE, CAL.—A committee of local firemen has advised the Board of Trustees to investigate and then adopt a new fire alarm system which Burbeck & Co. agreed to maintain for a monthly rental of $20.

VICTORIA, B. C.—William Sutton, a lumberman of Euculet District, Barclay Sound, is erecting a complete electric power transmission plant, to be driven by water power, to be used for transporting logs from timber land to water. The electric motors will displace the use of teams or horses and portable steam engines.

SEATTLE, WASH.—In revenge for a fancied grievance, a miscreant crossed an arc and an alternating incandescent circuit with several strands of bell wire, the result of which, probably fifty telephones were burned out, together with a dozen or more fire alarm boxes, and the lighting service on the crossed circuits was interrupted for the night.

LOS ANGELES, CAL.—The oil producers of this city have organized by adopting a Constitution for the formation of an Oil Producers' Exchange, which will endeavor to put in pipe lines to the ocean, so that shipment can be made by water, thus widening the market. It is believed that by this means oil can be landed in San Francisco for $1.30 per barrel.

TACOMA, WASH.—An ordinance has been enacted establishing new rates of lighting service from the municipal plant and which reduces the old rates approximately as follows: All night arc lights, 20 per cent.; midnight arc lights, 37 per cent.; half arc lights, 30 per cent.; incandescent commercial lights, 50 per cent. The Board of Public Works claims this to be necessary because of alleged violations by the Commercial Electric Light Company of an agreement with the city to maintain the old ordinance rates, while the company denies this but claims that the introduction of the Welsbach business have cut into the city's business. A rate war is now being waged between the city and the company, and the Tacoma Gas and Electric Light Company has under consideration the bringing of a suit to enjoin the city from selling any lights at less than cost.

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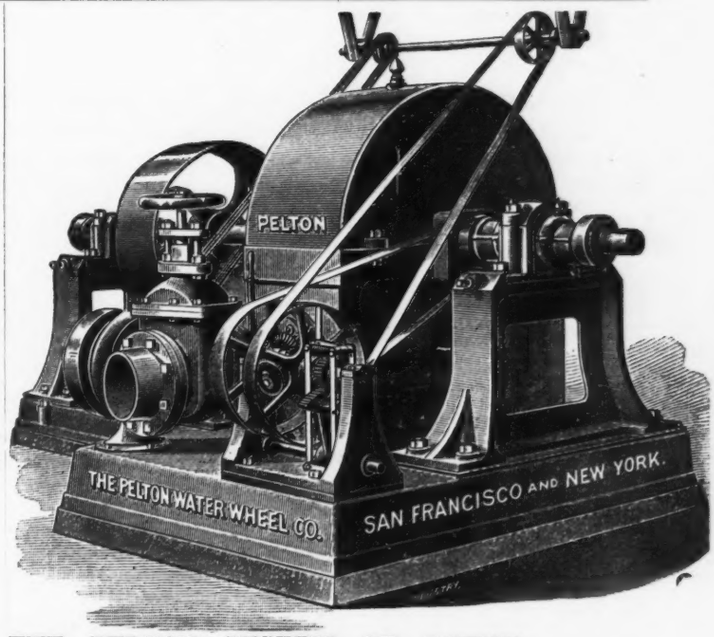

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TELEPHONE LINES AND THEIR PROPERTIES. By William J. Hopkins. 12mo, cloth. Illustrated. New York, 1893. 258 pages. Price, $1.50.

TELEPHONE TROUBLES AND HOW TO FIND THEM. By C. H. Haskins. A Complete Hand-book for Telephone Inspectors. 5th edition. Illustrated. 16mo, paper. Milwaukee. 1892. Price, $0.25.

A MANUAL OF TELEPHONY. By William Henry Preece, F. R. S., and Arthur J. Stubbs. 12mo, cloth. London, 1893. 333 Illustrations. 508 pages. Price, $4.50. Reviewed in The Electrical Journal for July, 1895.

TELEPHONES. By J. Allsop. Their Construction and Fitting. A Practical Manual of the fitting up and maintenance of Telephones and Auxilliary Apparatus. 12mo, cloth. 191 pages, 168 illustrations. London, 1891. Price, $2.00.

BELL'S ELECTRIC SPEAKING TELEPHONE. By Geo. B. Prescott. Its Invention, Construction, Application, Modification and History. New edition, revised and enlarged. 795 pages, 516 illustrations. 8vo, cloth. New York, 1890. Price, $6.00.

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PHILIPP REIS, INVENTOR OF THE TELEPHONE. By Silvanus P. Thompson. A Biographical Sketch with Documentary Testimony. Translation of the Original Papers of the Inventor and Contemporary Publications. 182 pages, 3 plates and 48 engravings. 8vo, cloth. London, 1883. Price, $3.00.

PRACTICAL TELEPHONE HAND-BOOK. By J. Poole. A Guide to the Telephone Exchange and Manual of Telephonic Working. With descriptions of latest appliances and instruments, faults and their localization and Wire Gauge Tables. 8vo, cloth. 288 pages, 227 illustrations. London, 1891. Price, $1.25.

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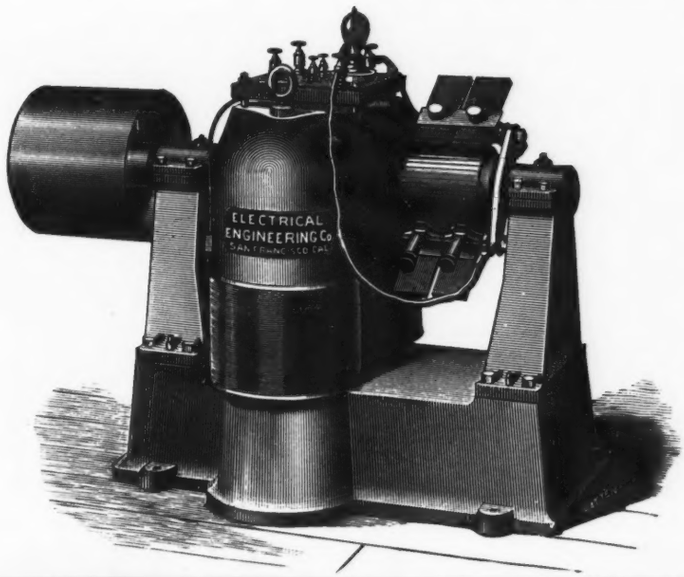

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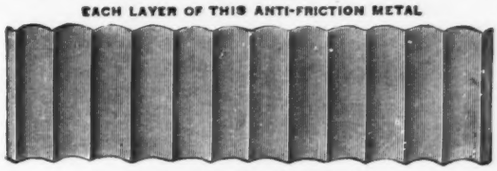

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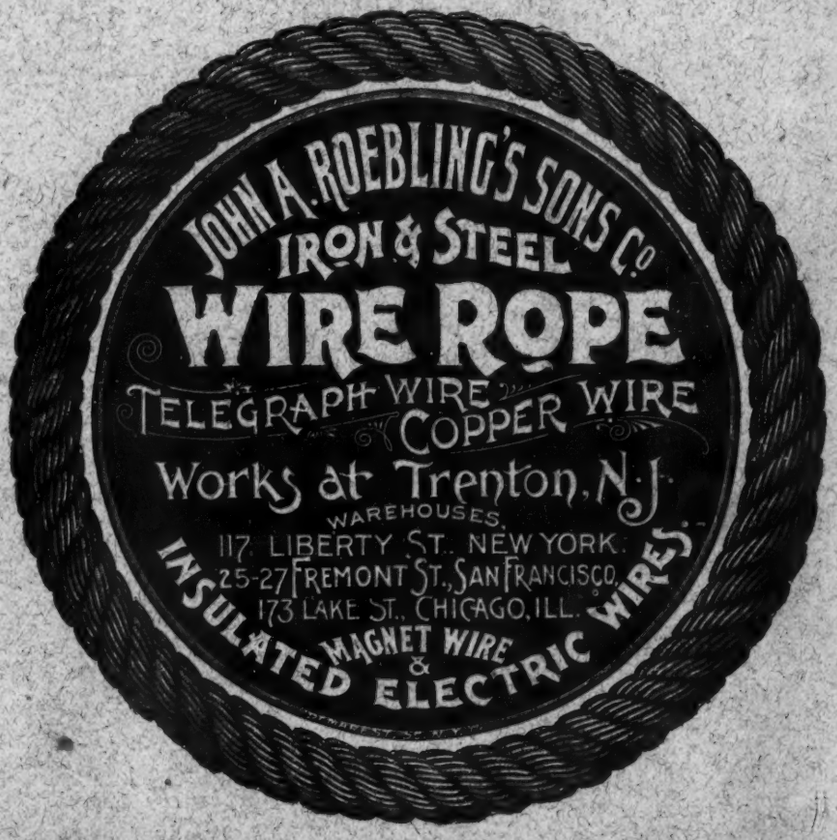

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